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ABSTRACT

The document is the second of a five-part series focusing in minute detail on the processes involved in the formulation of an instructional systems development (ISD) program for military interservice training that will adequately train individuals to do a particular job. Phase II, Design, is concerned with designing instructional materials based on the job analysis information presented in Phase I and consists of four steps. The first step, Develop Objectives, reviews tasks, elements, and job performance measurements and converts them into learning objectives which describe what is to be learned in terms of expected student performance under specified conditions to accepted standards. The second step, Develop Tests, describes developing appropriate testing procedures to match the learning objectives. The third step, Describe Entry Behavior, focuses on the entry behavior of the students, which defines the limits of the instruction and any required remedial or preparatory lessons. Finally in the fourth step, Determine Sequence and Structure, proper sequencing of learning objectives is established to help the learner make the transition from one skill to another and assure that supporting skills and knowledges are acquired before dependent performance requirements or subject matters are introduced. A list of references, glossary, and index are included. (Author/EC)

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INTERSERVICE PROCEDURES FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT

PHASE II: DESIGN

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PHASE II: DESIGN

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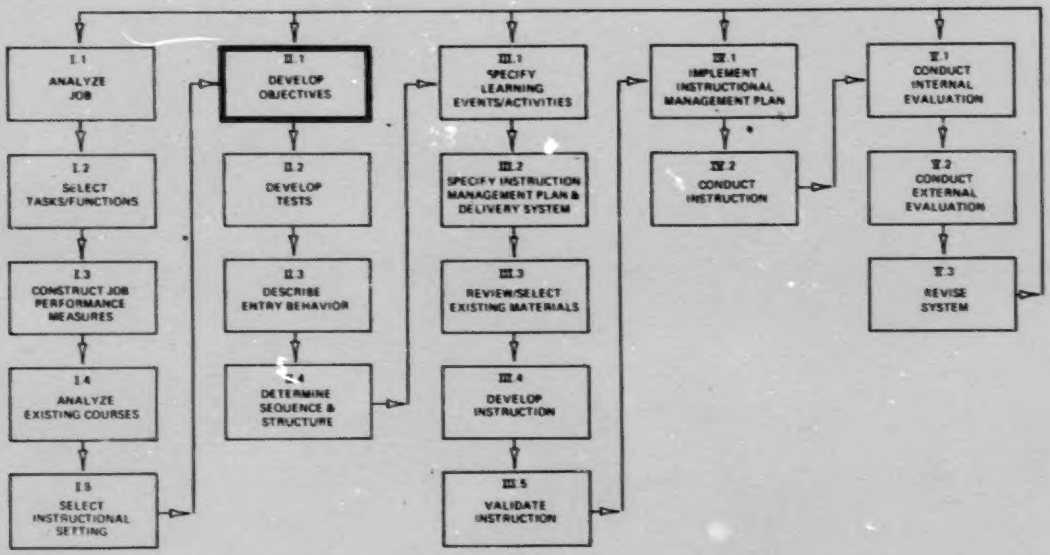
BLOCK II.1: DEVELOP OBJECTIVES*


I.1 ANALYZE JOB
I.2 SELECT TASKS/FUNCTIONS
I.3 CONSTRUCT JOB PERFORMANCE MEASURES
I.4 ANALYZE EXISTING COURSES
I.5 SELECT INSTRUCTIONAL SETTING
II.1 DEVELOP OBJECTIVES
II.2 DEVELOP TESTS
II.3 DESCRIBE ENTRY BEHAVIOR
II.4 DETERMINE SEQUENCE & STRUCTURE
III.1 SPECIFY LEARNING EVENTS/ACTIVITIES
III.2 SPECIFY INSTRUCTION MANAGEMENT PLAN & DELIVERY SYSTEM
III.3 REVIEW/SELECT EXISTING MATERIALS
III.4 DEVELOP INSTRUCTION
III.5 VALIDATE INSTRUCTION
IV.1 IMPLEMENT INSTRUCTIONAL MANAGEMENT PLAN
IV.2 CONDUCT INSTRUCTION
V.1 CONDUCT INTERNAL EVALUATION
V.2 CONDUCT EXTERNAL EVALUATION
V.3 REVISE SYSTEM

OVERVIEW

This block has as inputs all of the outputs of Phase I: Tasks selected for training, JPMs, and training setting selections. The tasks, elements, and JPMs are carefully reviewed and converted into learning objectives. Learning objectives describe precisely what is to be learned in terms of the expected student performance under specified conditions to accepted standards.

These learning ojectives are necessary to bridge the gap between performing a task and learning how to perform a task. Precisely stated learning objectives define for the student, instructor, instructional designer, and test writer exactly what is required of them.

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*Portions of this material have been adapted from: Department of the Air Force. Handbook for designers of instructional systems: Objectives and tests (Vol. III; AFP 50-58). Washington, D.C.: Headquarters, U.S. Air Force, July 1973.

2

DEVELOP OBJECTIVES

1.0 INTRODUCTION

Job tasks for which training must be provided have been identified in the first phase of the ISD model. Job performance measures (JPMs) have been developed to measure performance on these tasks. In those cases where it was impractical to measure actual job performance, the JPMs were designed to provide practical high-fidelity measurement alternatives. Since the primary objectives of training is to produce individuals who can perform adequately on the job, and since the JPMs are the best practical measure of performance, the JPMs are the basis for developing learning objectives.

Some JPMs closely resemble the actual task, and the terminal learning objectives (TLOs) written for them will closely resemble the actual task statement. Other JPMs will only approximate the actual task, but the learned behavior should be virtually identical to the behavior on the job.

Clerical, administrative, and some technical tasks can be duplicated in the school environment. The following examples contain the behavior portion of tasks that are readily converted to terminal learning objectives (TLOs) in school settings.

EXAMPLES

Task statements from weather controlman.
1. Answer telephone inquiries about the weather.
2. Evaluate pilot reports.
3. Disseminate weather warnings.

Task statements from Disbursement Accounting Clerk.
1. Computer travel allowances.
2. Maintain individual travel records.
3. Maintain files of travel documents and records.

Task Statements from recruiter.
1. Establish rapport and credibility with prospect.
2. Determine whether the prospect meets the minimum requirements for service.
3. Uncover the prospects needs and interests.

Task statements from Helicopter Maintenance.
1. Align and balance main rotor blades of the OH-58A.
2. Troubleshoot hydraulic system.
3. Replenish hydraulic system.

In some tasks, only portions of the actual required behavior, conditions, and standards from the job world can be represented in the school setting. The following example contains the behavior portion of some of these task statements.

EXAMPLES

Splint a fractured leg
Dispose of radioactive waste

It has been estimated that only 15 percent of tasks fall into the category of those which cannot completely be represented in the school environment. Normally, though, these tasks have high consequences of inadequate performance and very low delay tolerance. Adequate training of these tasks is, therefore, critical but difficult.

In some cases, the terminal learning objectives (TLOs) will represent the behavior accurately, but will not require the ultimate level of proficiency that is required on the job. In many troubleshooting, maintenance, and repair tasks, job conditions require speed and proficiency which cannot readily be achieved in the school. It is expected that these high levels of speed and proficiency will be achieved on the job after initial school training.

It is important to note that performance of a task and learning to perform a task are distinctly different. Details of how the task is performed have already been carefully documented. Now the concern is for the details of learning to perform the task. A major part of these details is clearly stated learning objectives. These objectives will specify what the learner will accomplish as a result of having received the instruction, and will specify to the instructional designer the exact behaviors the instruction is expected to produce.

Prior to designing instruction to train individuals to perform tasks, it is necessary to translate the tasks into terminal learning objectives (TLOs) to be attained during training. This means that each task must be analyzed to determine what a person needs to be able to do in order to perform the task successfully. During this analysis, TLOs are broken down into their component parts which are documented as learning objectives (LOs) which may be further divided into learning steps (LSs). These learning objectives will identify the mental skills, information, attitudes, or physical skills that are required to perform the TLOs.

Terminal learning objectives (TLOs) are the highest classification of learning objective in the ISD model. TLOs are the direct translation of the JPMs into the training world. Analysis of the TLOs result in additional learning objectives (LOs). LOs provide the level of detail necessary to describe the major components that must be learned in order to perform the TLOs. Learning steps (LSs) are derived through analyzing the learning objectives (LOs) into levels of detail necessary to describe all the components that must be learned in order to perform the LOs.

TLO and LO statements should specify the action, conditions, and standards which can be measured by test (oral, written, or performance). TLOs and LOs can be effectively developed to support all four types of learning categories: mental skills, information, physical skills, and attitudes. TLOs and LOs have three general word groups, or characteristics: actions, conditions, and standards.

EXAMPLE

"When the trainee completes this instruction, he will be able to:

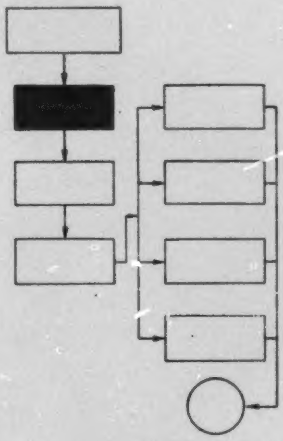
(action)	Add a column of figures containing 10 4-digit numbers
(condition)	given paper and pencil
(standard)	in 2 minutes correctly."

LSs do not need to specify the conditions and standards but do need a clear statement of the action: e.g., locate the clutch.

The procedures for developing learning objectives are shown in Figure II.1, the foldout page at the end of this block.

2.0 PROCEDURES

2.1 Prepare Terminal Learning Objective for Each Task



The first step in developing learning objectives is to prepare terminal learning objectives (TLOs) which are direct translations of the JPMs into objectives for the training world. These TLOs will describe the actions, conditions, and standards which will be met in the training world to prepare the person for the job world.

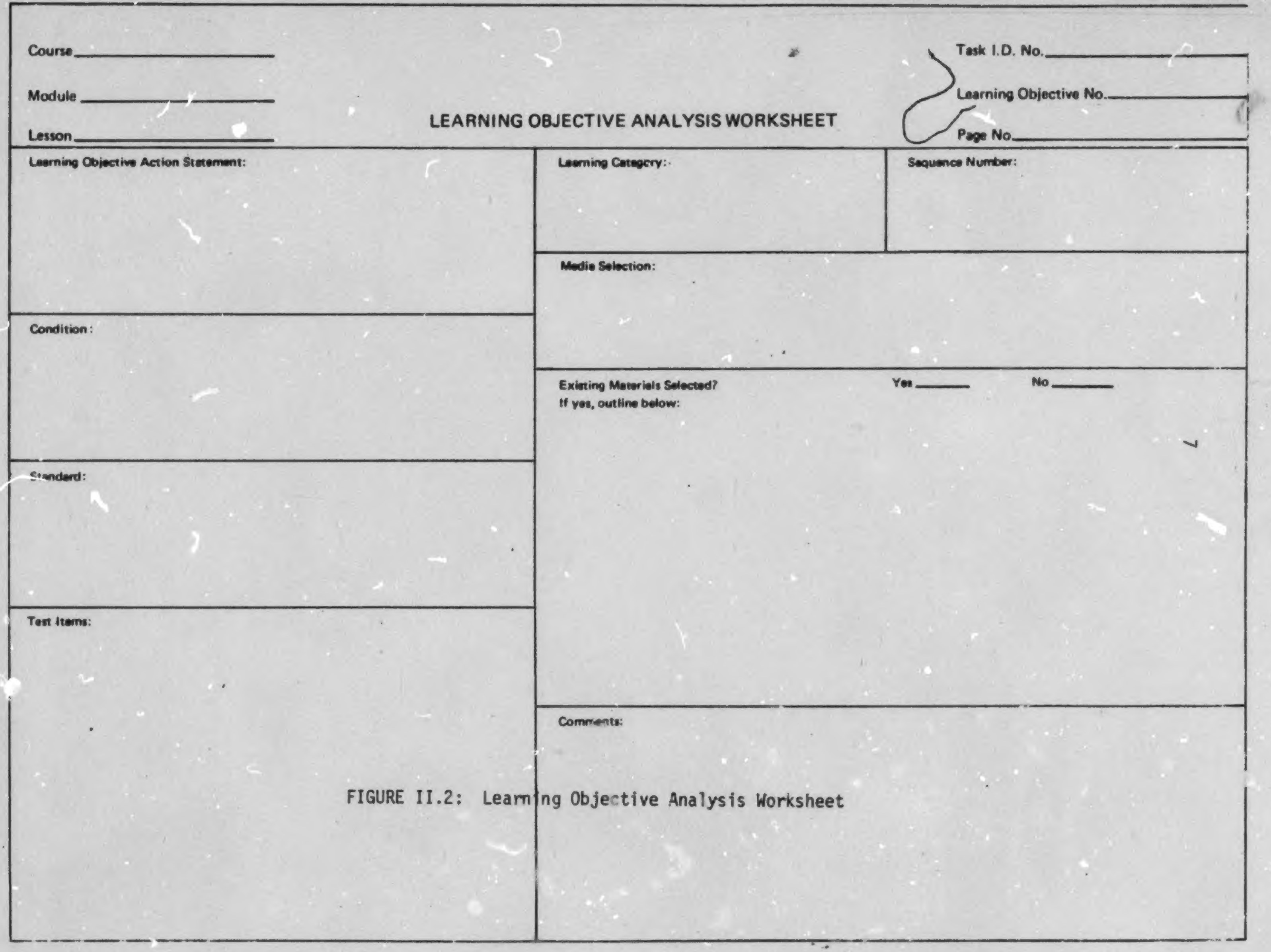
A TLO is:

1. a specific description of the action the learner is to exhibit after training,
2. the conditions under which the action will take place, and
3. the standards or criterion which must be reached.

TLOs are intended to be directly related to job task performance even when the action, conditions, and standards cannot be identical. In many tasks, these will be identical and there will be no need to sacrifice fidelity.

The TLOs should be documented on a form similar to the one shown in Figure II.2.

Traditionally, words used to describe course content and objectives have been vague, and susceptible to misinterpretation. The learning



LEARNING OBJECTIVE ANALYSIS WORKSHEET

Course ____________

Module ____________

Lesson ____________

Task I.D. No. ____________

Learning Objective No. ____________

Page No. ____________

Learning Objective Action Statement:

Learning Category:

Sequence Number:

Media Selection:

Condition:

Existing Materials Selected? Yes ______ No ______
If yes, outline below:

Standard:

Test Items:

Comments:

FIGURE II.2: Learning Objective Analysis Worksheet

5. There must be a standard against which the student behavior will be measured. It must be fully specified.
6. The statement of the conditions under which the student behavior will occur must be fully specified.

Table II.1 shows the three parts of a well-stated learning objective, and Table II.2 shows how to write the three parts of the objective. The balance of this section gives further details on writing these three parts.

2.1.1 The Action Part of a TLO or LO

An instructor cannot read the mind of the student to see how well he understands. Only through some overt activity of the student can the extent of his knowledge or skill be measured. So, the action part of a learning objective should specifically state what the student does.

"Develop an understanding of Ohm's Law" is an unspecific, obscure learning objective. It can be interpreted too many ways. One person may feel that the student's reciting the law indicates understanding. Another may say that the student should be able to explain the law. A third may contend that the only way the student can satisfy this learning objective is for him to actually use the formula in solving electrical-circuit problems.

EXAMPLE

> "Given the mathematical formula for Ohm's Law, when current and resistance are known, and a slide rule (condition), determine applied voltage (action) correctly to three significant figures (standard)."

TABLE II.1 The Three Parts of a Well-Stated Learning Objective

CONDITION(S) (INPUT)	PERFORMANCE/ BEHAVIOR(S) (ACTION)	STANDARD(S) (OUTPUT)
Description of the condition(s) of performance--What is presented to the student	Description of the action or behavior--What the student is expected to do	A statement of the output or outcome of the performance and the standard(s) of performance

TABLE II.2 How to Write the Three Parts of an Objective

TO WRITE CONDITIONS, SPECIFY WHAT STUDENT IS GIVEN	TO WRITE PERFORMANCE/ BEHAVIORS, SPECIFY WHAT STUDENT DOES	TO WRITE STANDARDS, SPECIFY OUTPUT (OR OUTCOME) AND HOW WELL IT IS DONE
INPUT(S) Include:	Use ACTION verbs that are:	OUTPUTS AND STANDARDS
Job Aids Equipment Technical References Special Tools Environmental Conditions Special Instructions Signals, Symbols Problem Situations or Contingencies	Observable Measurable Verifiable Reliable (not prone to varying interpretation)	Criteria for Standards: Completeness Accuracy Types of Standards: Standard Operating Procedure (SOP) No Error Time Requirements Amount of Supervision Qualitative Indices

This is a more precise learning objective. An objective stated this way lets everyone--the student, instructor, supervisor, measurement personnel, writers, and course managers--know exactly what the student must learn. It states what action the student should exhibit.

The action described in the learning objective must allow the test writer to prepare proper items to measure it. Clearly, learning objectives that call for one type of behavior and tests that require another type of behavior can only lead to confusion and have no place in the ISD process. If you find that the objectives you have written are not consistent with the tests, you will have to revise the test items, the learning objectives, or both until they match.

The main intent of the action verb is to reflect the type of learning. If we desire the student to learn information, this implies that he will be required to STATE something. For mental skills, the student will be required to DEMONSTRATE his ability to use that skill. Evidence of the capability to perform a physical skill requires that the student EXECUTE the skill. And, attitudes require that the student CHOOSE among alternative courses of action.

Using action verbs reduces ambiguity. Unless you specify student actions with an action verb, the student will probably end up doing something else. The verbs you select must reflect behaviors that are observable, measurable, verifiable, and reliable. Use action verbs that meet criteria, and that are appropriate to the training and the test. Some examples of suitable verbs are given in Table II.3.

TABLE II.3 Examples of Suitable Verbs for Each of the Four Types of Objectives

INFORMATION	MENTAL SKILL	PHYSICAL SKILL	ATTITUDE
State	Demonstrate	Execute	Choose
Name	Discriminate	Operate	Volunteer
Recite	Classify	Repair	Allow
Describe	Generate (a solution)	Adjust	Recommend
List	Apply (a rule)	Manipulate	Defend
Relate	Solve	Handle	Endorse
Tell	Derive	Manufacture	Cooperate
Write	Prove	Calibrate	Accept
Express	Analyze	Remove	Decide to
Recount	Evaluate	Replace	Agree

When the expected performance has been successfully analyzed into the proper types of learning, you can indicate clearly what it is that the learner is to do. These indications require precise statements. Each action statement can contain two verbs. The first may indicate the kind of objective that is being written (see Table II.3) and the second will indicate how the learner will perform the action indicated. The exception occurs when there can be no confusion: "Sing the Star Spangled Banner." But, "Describe the relationship between..." could easily mean either orally or in writing. So, if there can be any doubt about the intention, use a second verb to indicate what the learner is to do.

Correctly written action statements will make it easier to add the conditions and standards and will make it easier for the person using your learning objectives to develop instruction.

2.1.2 The Conditions Part of a TLO or LO

A properly prepared learning objective clearly states the limits and/or conditions of student performance. This portion of the learning objective describes the important aspects of the performance environment. What does the student have to work with? Can he select his own tools? Are technical orders or checklists available as a starting point? The conditions portion of the learning objective should specify the objects, events, words, or symbols which will be presented to the student. Several sample statements of conditions are shown in Table II.4.

TABLE II.4 Sample Statement of Training Conditions

GOAL	EXAMPLE
State the conditions imposed upon the student.	"Given the diameter of a sphere and the appropriate formula, compute the surface area of the sphere. The student does not have to memorize or derive the formula. He solves the problem using the formula provided.
Do not overuse the word "given." Use variations.	"Field-strip and assemble an M-16A1 rifle under conditions of total darkness." This implies that the student will be provided with the rifle, and requires that he strip and assemble the weapon in complete darkness.
Establish the working conditions.	"Using available library resources prepare a staff study comparing the communications support contributions made by five military leaders during the nineteenth century."

A TLO or LO may require more than one statement of condition in order to secure the desired action. On the other hand, in some cases the condition may be implied, as in the case of "Recite the Gettysburg Address," the condition "from memory" may be omitted since it is implied by the verb "recite."

2.1.3 The Standards Part of the TLO or LO

A third requirement for a well-prepared learning objective is a clearly stated measurable standard of performance. The criteria for standards, completeness, and accuracy are summarized in Table II.5.

TABLE II.5 Criteria for Standards in Objectives

CRITERIA FOR GOOD STANDARDS	WHAT IS SPECIFIED
Completeness	The precise nature of the output. Number of features that output must contain. Number of steps, points, pieces, etc., that must be covered or produced. Any quantitative statement that indicates acceptable portion of total.
Accuracy	How close to correct the performance must be. Exact numbers reflecting tolerances. Values or dimensions that acceptable answers/performance can assume. (These may be qualitative.)
Time	How many days, hours, minutes, or seconds can be used.

The student's action will result in an output, the quantity or quality of which is the standard of performance. You must determine which one or more of the six types of standards shown in Table II.6 the student will have to meet.

TABLE II.6 Six Types of Standards for Objectives

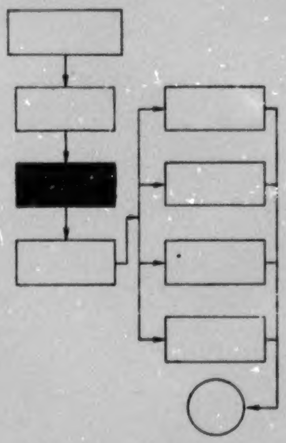
NO.	DESCRIBE STANDARDS BY	EXAMPLE
1	Referring to a Standard Operating Procedure	"Given the situational requirements for an instrument approach, and the local airfield regulations, perform the procedure the pilot follows to complete an instrument landing. The performed steps will be in correct order and will comply with local regulations."
2	Implying the standard of NO ERROR	"Given the diameter of a sphere and the appropriate formula, use a calculator to compute to two decimal places the surface area of the sphere." Adding "He will perform without error" would not increase the requirement for accuracy.
3	Specifying minimum acceptable level of performance	"Using a slide rule, multiply two three-digit numbers and write the answer to the nearest tenth." This clearly states the degree of accuracy required for satisfactory achievement of the objective.
4	Specifying the time requirements	"Given a 200-word rough draft, type a letter without error at a minimum speed of 40 words per minute." Time is an important factor, so it is included in the objective.
5	Specifying the rate of production	"Given a rough draft of a final report, type pages without error at a minimum of 20 pages per day." The amount produced daily is an important factor, so it is included in the objective.
6	Specifying qualitative requirements	"Given a misadjusted carburetor and necessary tools, adjust the carburetor to idle at its smoothest point." Smoothness is a qualitative standard.

When writing standards, quantify where possible. (Remember, however, that the sixth type of standard in Table II.6 is qualitative, and usually can be quantified only through rating procedures.)

1. Many standards are quantifiable:
    a. Exact number of words typed per minute
    b. Following the 10 steps of a procedure
    c. Listing the 206 bones in the human body
2. Some standards are not directly quantifiable:
    a. adjusting a carburetor until the engine runs at its smoothest point
    b. making a patient feel comfortable (you could follow a procedure, but not succeed if you were hostile)

2.2 Determine Appropriate Learning Category For Each TLO

Before a learning analysis can be made of the TLOs, the appropriate learning category must be determined for each TLO. This is because each learning category is analyzed differently.



The ISD model includes four categories of learning in which most, if not all, TLOs, LOs, and LSs fall. These categories include the learning of mental skills, information, physical skills, and attitudes. A description of each of these follows:

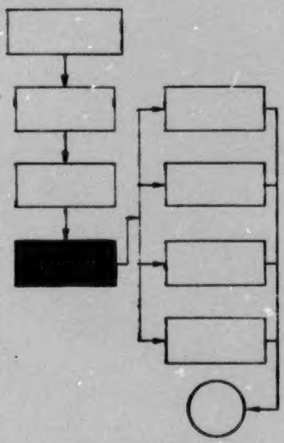
1. Mental skills: Those processes of identifying, classifying, using rules, and solving problems that involve active mental

processing. Mental skills imply the capability of applying the learning to some situation and demonstrating the mental skill. Mental skills involve thinking, creating, and analyzing.

2. Information (Recalling bodies of knowledge): This involves the learning of names, labels, facts, nomenclature, or larger bodies of knowledge that are necessary for successful job performance. Information implies that the person can store and recall the knowledge.
3. Physical skills: These involve some physical or manipulative activity. They require movement of some of the muscles of the body and are directly observable (sometimes called psychomotor skills).
4. Attitudes: These are not always directly observable but are reflected in the choices a person makes. Attitudes are indicated by a person's behavior. Thus, a person with a positive attitude towards job safety is one who chooses to practice good safety habits.

To determine the proper category for a particular TLO requires consideration of what must be learned in order to master the TLO. The learning analysis will then proceed according to the guidelines for the most appropriate category. If this analysis reveals LOs that more appropriately fit a different category of learning, you will further analyze such LOs according to the guidelines for the new category.

2.3 Perform Learning Analysis for Each Terminal Learning Objective



First, analyze each TLO to determine the learning objectives (LOs) and learning steps (LSs) necessary to master the TLO. These LOs and LSs will give the instructional designer the level of detail needed to design instruction. At this point, state clearly all the assumptions about the entry behaviors of students for whom the instruction will be developed; that is, decide what skills and knowledges the typical student already has. Later these assumptions will be tested and corrections made where the assumptions were wrong. The reason for making these assumptions here is to save considerable work in analyzing objectives. The TLOs need to be analyzed; that is, broken down into finer details of what must be learned to the point that further analysis is not required since the students already can master the details.

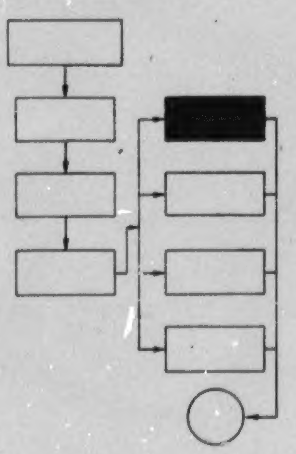
EXAMPLE

> If the action portion of an LO is "calculate mean scores" and you have analyzed this to the level of detail of "add column of numbers," you need not analyze this LO further if you are reasonably certain the students already can add columns of numbers.

Details of performing learning analyses for the four categories of learning are given in the final four sections of this block. All of the new LOs and LSs should be documented on a form similar to the learning objective analysis worksheet shown in Figure II.2, page 7.

The important consideration is to identify all of the important mental skills, information, physical skills, and attitudes. Once you have completed this analysis, try to eliminate any mental skill, information, physical skill, or attitude that is not essential even if it may be nice to know.

2.3.1 Perform Learning Analysis for the Mental Skills Category



For those items in the mental skills category, identify those mental skills that must be learned before a person will be able to learn the mental skills that have been identified. For example, if the mental skill is that of decision making, the analysis should reveal the rules and concepts that a student must possess before he is able to solve the problem. The purpose of the analysis of mental skills is to identify those capabilities that a student must possess before he can learn the skill to be taught.

Mental skills include rule using and learning, identifying symbols, classifying, using verbal information, detecting and making decisions.

EXAMPLES

Learning Sub-Categories	Examples of Learning Objective Action Statement
I. Mental Skills	
1. Rule learning and using	Select the proper fire extinguisher for the following classes of fires:

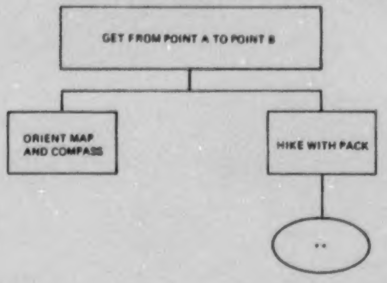
		a. ordinary combustible materials b. flammable liquids c. electrical fires
2.	Classifying--recognizing patterns	Identify U.S. and U.S.S.R. destroyers
3.	Identifying symbols	Identify Medical Service Symbols
4.	Detecting	Visually detect camouflaged armored vehicles in a terrain setting
5.	Making Decisions	Select a diagnostic strategy for a malfunction in the main drive shaft

To analyze ment

To analyze mental skills, repeatedly ask the question "What does the learner have to be able to do in order to do this task?" The breaking down of the skill into its component parts results in a set of subskills. The subskills will form a hierarchy which will be helpful later in sequencing objectives. A learning hierarchy shows the progression from simple skills to more complex. Often, the TLO will have many LOs and LSs.

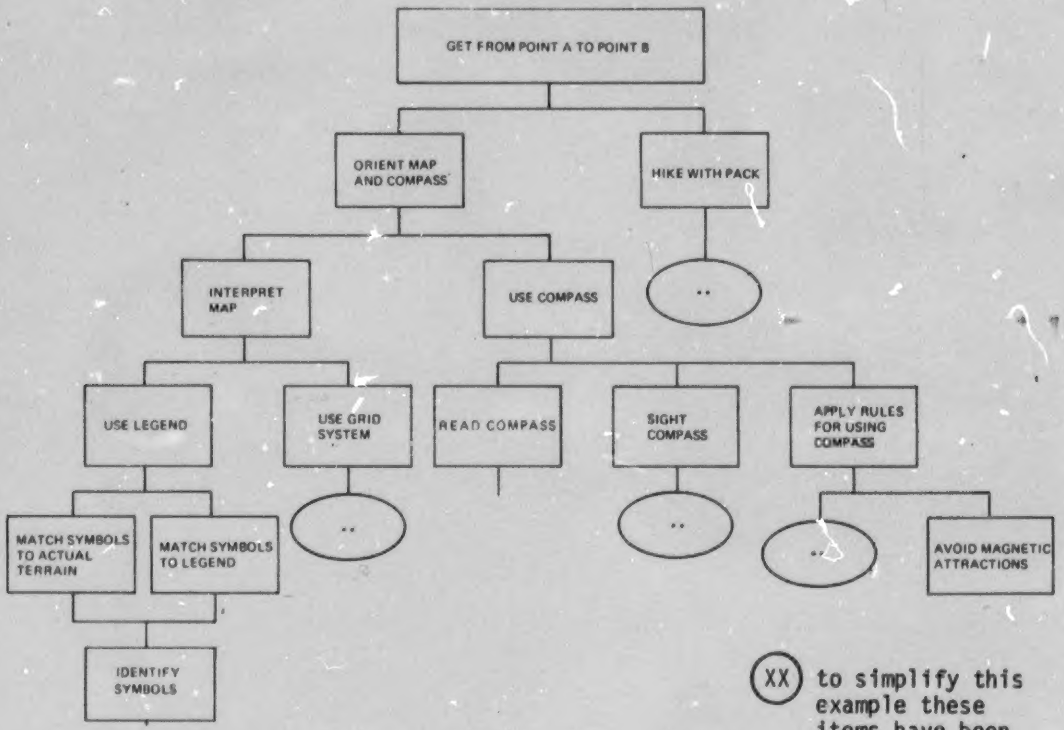
EXAMPLE

Start with the JPM, "Get from point a to point b," then ask the question "What does the learner have to be able to do to get from point A to point B?"



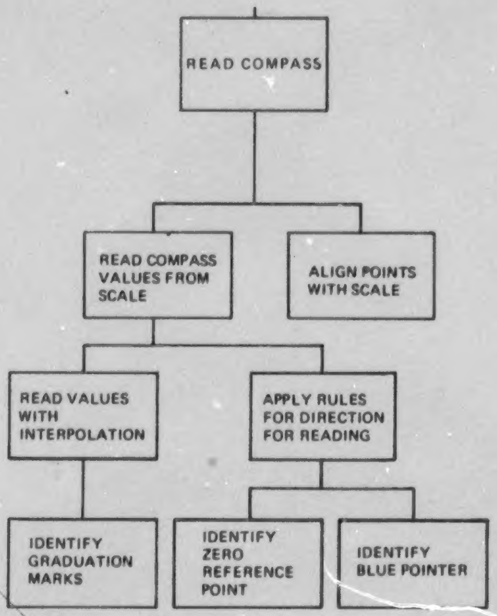
*"Hike with pack" looks more like a physical skill, and should be analyzed as such. Here we are concerned only with mental skills.

Again ask the same question for each subskill:


GET FROM POINT A TO POINT B
ORIENT MAP AND COMPASS
HIKE WITH PACK
INTERPRET MAP
USE COMPASS
..
USE LEGEND
USE GRID SYSTEM
READ COMPASS
SIGHT COMPASS
APPLY RULES FOR USING COMPASS
MATCH SYMBOLS TO ACTUAL TERRAIN
MATCH SYMBOLS TO LEGEND
..
..
..
AVOID MAGNETIC ATTRACTIONS
IDENTIFY SYMBOLS

XX to simplify this example these items have been omitted.

To continue:


READ COMPASS
READ COMPASS VALUES FROM SCALE
ALIGN POINTS WITH SCALE
READ VALUES WITH INTERPOLATION
APPLY RULES FOR DIRECTION FOR READING
IDENTIFY GRADUATION MARKS
IDENTIFY ZERO REFERENCE POINT
IDENTIFY BLUE POINTER

This analysis continues until the newly identified elements are ones that the intended trainees already can do.

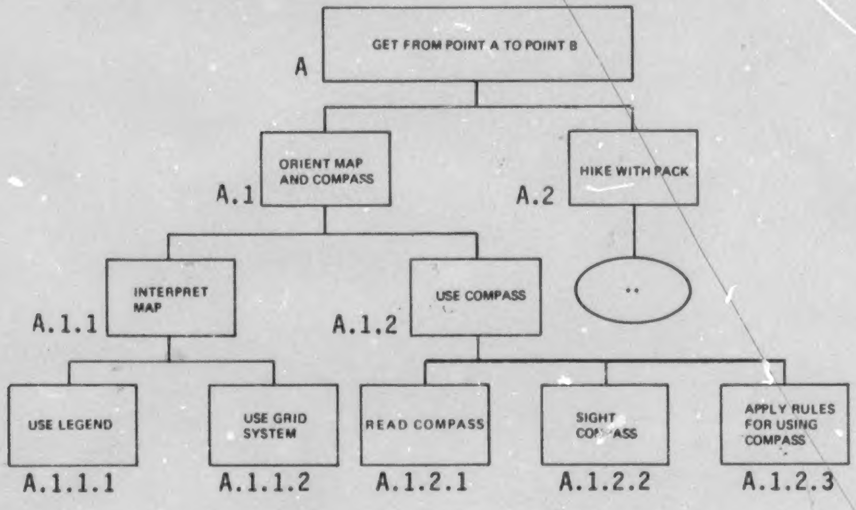
To identify the learning subskills for mental skills ask:

> What thought processes (discriminating, identifying, classifying, rule using, decision making) must a person be able to perform in order to achieve this learning objective?

Although rough copies of hierarchical charts are needed in actually performing the learning analysis, in documenting the results of the analysis on mental skills which results in a hierarchical structure, it is best to represent the hierarchy as in the following example.

EXAMPLE

> Each TLO is assigned a letter A-Z. The LOs and LSs which make up that TLO are specified by prefacing each LO and LS with the letter of the TLO followed by the appropriate numbering.


GET FROM POINT A TO POINT B
A
ORIENT MAP AND COMPASS
A.1
HIKE WITH PACK
A.2
INTERPRET MAP
A.1.1
USE COMPASS
A.1.2
..
USE LEGEND
A.1.1.1
USE GRID SYSTEM
A.1.1.2
READ COMPASS
A.1.2.1
SIGHT COMPASS
A.1.2.2
APPLY RULES FOR USING COMPASS
A.1.2.3

DOCUMENTATION OF ANALYSIS

A. Get from point A to point B

A.1 Orient map and compass

A.1.1 Interpret map
A.1.1.1 Use legend
A.1.1.2 Use system

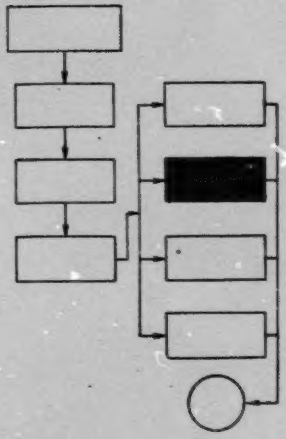
A.1.2 Use compass
A.1.2.1 Read compass
A.1.2.2 Sight compass
A.1.2.3 Apply rules for using compass

A.2 Hike with pack

The letter/number combination from the above example could be interpreted as the objective number on the learning objective analysis worksheet shown in Figure II.2.

2.3.2 Perform Learning Analysis for the Information Category

For those learning objectives in the category of information, the analysis can proceed by asking how the information is related to other knowledge that the student already has or must have in order to successfully perform the task. In asking this question it is possible to identify any other information that must be acquired.



EXAMPLE

Learning Subcategory	Example of Learning Objective Action Statement
II. Information 6. Recalling bodies of knowledge	Describe the rules of war including forbidden targets, tactics, and techniques; treatment of captives, detainees, civilians and private property; and what to do when crimes are committed.

The learning of information does not require the student to produce or create anything new. He may receive information and reproduce it in his own words. Isolated pieces of information are hard to remember or use, but some information is learned the first time it is heard or read, such as: Pay day is every other Thursday.

To identify the learning objectives for information, ask:

> "What information must a person know (be able to recall or state) in order to achieve this learning objective?"

The analysis continues until all relevant facts have been identified, and include all information the students do not already know.

Given a performance oriented task analysis, information tasks should be rare. However, for some combat tasks the only practical alternative may be to develop a low physical fidelity TLO that is principally information. The reasons may be:

1. Evidence that "knowing" the information has high predictive validity.

2. No job criterion therefore no rationale for going to simulation.

3. A shortage of training resources or time.

EXAMPLES

1. TLO: Describe the rules of war.

   Include:

   (1) Forbidden Targets, tactics, and techniques:
   a.
   a. Do not attack non-combatants.
   b. Do not cause destruction beyond the requirements of your mission.
   c. Do not attack protected property.
   d. Do not shoot at the Red Cross.
   e. Do not hide behind the medical service symbols.
   f. Do not shoot at a parachute.
   g. Do not use poison or personal weapons.
   h. Do not alter your weapons or ammunition to increase enemy suffering.

   (2) Treatment of captives and detainees:
   .
   .
   .

   (3) Treatment of civilians and private properties:
   .
   .
   .

   (4) What to do when crimes are committed:
   .
   .
   .

   Conditions: On paper, with no references.
   Standards: All four areas must be included. Within each area no more than one rule can be omitted.

2. If an information goal is stated "Be familiar with the basic regulations governing the enlistment process" the action has to be redefined with action verbs. Three action portions of TLOs were derived from the goal statement.

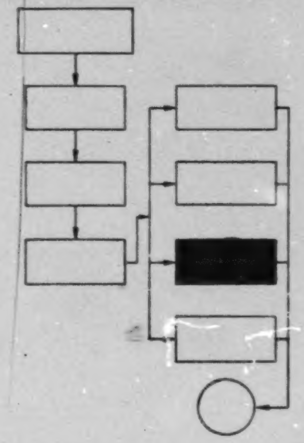
   (1) Determine basic enlistment criteria
   (2) Determine enlistment criteria for specific options
   (3) Determine waiverable/non-waiverable enlistment disqualification.

When you ask the question what information must a person be able to recall in order to achieve this for (1), some of the LOs are:

a. Given a copy of the regulation and a series of prospects, present the enlistment options, and
b. Match the prospects qualifications with the specific enlistment criteria for the prospects' chosen option(s).

2.3.3 Perform Learning Analysis for the Physical Skills Category

In the analysis of physical skills, it is necessary to specify the individual movements and sequencing of those movements that form the total skill. There are four subcategories of physical skills:



EXAMPLE

Learning Subcategories	Examples of Learning Objective Action Statement
III. Physical Skills	
7. Performing gross motor skills	Load the Chaparral
8. Steering and guiding--continuous movement	Assemble and disassemble the M203 grenade launcher.
9. Positioning movement and recalling procedures	Communicate with divers at a depth of 30 meters using telephone equipment.
10. Voice communicating	

To identify the learning objectives for physical skills ask:

What motor activities must a person be able to perform in order to achieve this learning objective.

This analysis continues until skills are broken down to the point that the components are ones the intended students can already do.

EXAMPLES

1. Install Components in an AN/PRC 77

Install battery   Install antenna   Install handset

Although these require information and mental skills to do them correctly, the process is also a physical skill and it can be analyzed that way. The easiest way to decide the steps for installing the battery is to write them in the order they are generally performed on the job.

1.1 Skills Required to Install Battery

1.1.1 Turn the function switch to the off position.
1.1.2 Stand the Receiver/Transmitter on a level surface with the front panel facing downward.
1.1.3 Simultaneously release the two battery box retaining clamps by pushing the topmost part of each clamp down and away from the Receiver/Transmitter case.
1.1.4 Remove the Battery Box by lifting upward.
1.1.5 Lay the Battery Box to one side on the working surface.
1.1.6 Position the Battery Connector in line with the Radio Connector until the connectors are mated.
1.1.7 Install the Battery Box on the Receiver/Transmitter.
1.1.8 Secure the Battery Case Retaining Clamps.

2. In preparation of AN/PRC 77 for operation, one part calls for inspecting the battery and battery box. "Inspect the battery and battery box in 3 minutes given an AN/PRC 77" could be a learning objective. If the learning objective is further analyzed there are many steps involved in inspecting. These could each be another LO or an LS. Since there are no conditions that are different from the LO, and there is no need for standards for the steps, they can all be subsumed under the LO as Learning Steps.

LO: Given an AN/PRC 77 inspect the battery and battery box in 3 minutes.

LSs:
2.1 turns the function switch to the OFF position
2.2 stands the receiver/transmitter (with all accessories removed) on a level surface with the front panel facing downward.

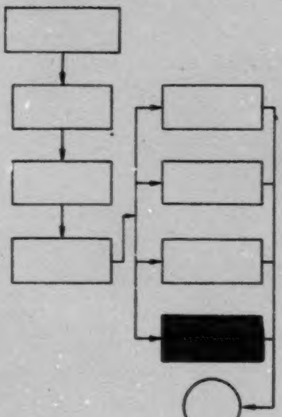
2.3 simultaneously releases the two battery box retaining clamps by pushing the topmost part of each clamp down and away from the receiver/transmitter case.
2.4 removes the battery box by lifting upward.
2.5 inspects the gasket or battery box for damage.
2.6 inspects the battery box for corrosion.
.
.
.
2.17 Stand the receiver/transmitter on a level surface with the front panel facing upward.

Obviously, some of these steps in the above examples could be analyzed further; however, these lists should be sufficient to give the general idea.

In these examples, there are two important aspects: the overall sequence of the skills and each individual physical skill. Since success in learning a physical skill depends on both the learning of the individual physical skills and the overall sequence of the physical skills, both must be described.

2.3.4 Perform Learning Analysis for the Attitude Category

The analysis in the category of attitudes is more difficult since it is not possible to observe attitudes directly. This analysis can proceed by asking the question, "What would a person do if he had the desired attitude?" This is done by writing down the things you would expect someone to say or do that would cause you to agree that he had the desired attitude. The purpose of the analysis of learning attitudes is to identify the specific performances



which must be treated. To perform an analysis on an attitude, ask:

> "What choices must a person make that would indicate the desired attitude?"

EXAMPLE

> If the desired attitude was that one has an "appreciation for safety," further analysis may indicate that the behaviors involved are wearing safety equipment, following safety rules, keeping the work-area free of any hazards, suggesting possible ways to improve the safety of his job, or reporting safety hazards.

The analysis of attitudes starts with the abstract idea, and proceeds to the behaviors that are acceptable as evidence of that attitude. This is because attitudes are difficult if not impossible to observe.

EXAMPLE

> If the desired attitude for radio operators is a protective attitude towards equipment, the question should be asked, "What does an operator who has a protective attitude do?" Some possible answers are:
>
> 1. Does not let the battery corrode.
> 2. Keeps the set and its components free of dirt and dust.
> 3. Does not lose any of the components.
> 4. Performs regular maintenance.
> 5. Keeps equipment in its carrying case.
>
> First, try to change any negative statements to positive ones. They are easier to observe:
>
> 1. Keeps the battery and battery case free from corrosion.
> 2. Keeps the components properly attached and stored.
>
> Next, remove duplications and items that are not good evidence. You might say that if he performs regular maintenance, the set and its components will be free of dirt and dust, so eliminate item 2. Also, keeping equipment in its carrying case is recommended only when equipment is being transported; it is not a good storage place. So eliminate 5. The results are:

1. Keeps the battery and battery case free from corrosion.
2. Keeps the components properly attached or correctly stored.
3. Performs regular maintenance.

These, then, are acceptable evidence that the operator protects his equipment and they are tangible things upon which instruction can be developed.

3.0 OUTPUTS

The outputs of this block should consist of:

3.1 Products

1. TLOs for tasks selected for training. These terminal learning objective statements will include conditions and standards. (See example, page 31.)
2. LOs and LSs resulting from the learning analysis of the TLOs. These will be documented in a format that shows the interrelationships between the items. (See Figure II.3, page 32, and example, page 33.)

3.2 Other Documentation

1. A summary statement of the assumptions made about student entry behavior.
2. Any revisions to JPMs resulting from the learning analyses.

EXAMPLES

Terminal Learning Objectives for Tasks Performed by OH-58 Helicopter Repairman:

1. In a maintenance work area using an OH-58 helicopter, Technical Manual 55-1520-228-20, a general mechanics tool kit, and a maintenance platform, the student will inspect the main transmission oil system in accordance with Technical Manual 55-1520-228-20.

2. The student will install a tail rotor gear box in accordance with Technical Manual 55-1520-228-20, given a general mechanics tool kit, DA Form 2408-13, Technical Manual 55-1520-228-20, an OH-58 helicopter, and a maintenance platform in a maintenance work area.

3. Given an OH-58 helicopter, Technical Manual 55-1520-228-20, DA Form 2408-13, and a general mechanics tool kit, the student will maintain the power train system in accordance with Technical Manual 55-1520-228-20, in a maintenance work area with a maintenance platform.

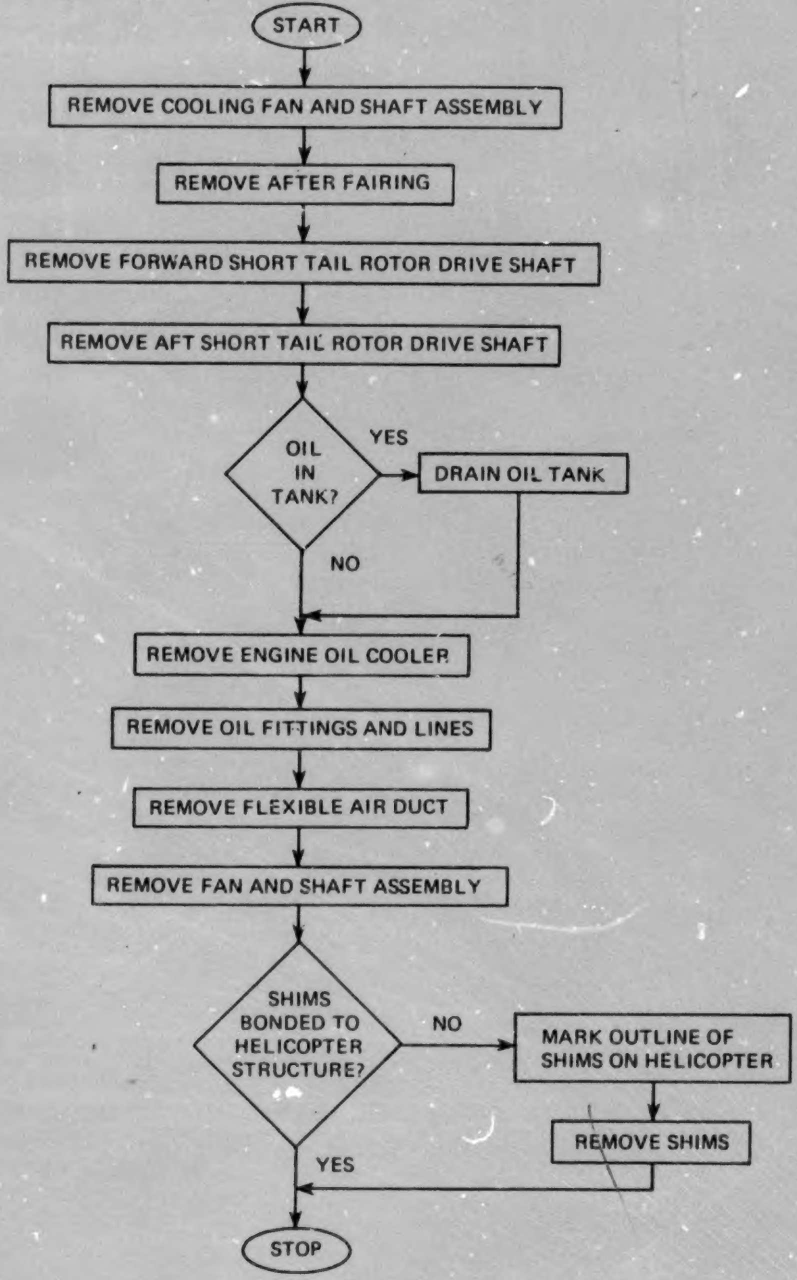

START
REMOVE COOLING FAN AND SHAFT ASSEMBLY
REMOVE AFTER FAIRING
REMOVE FORWARD SHORT TAIL ROTOR DRIVE SHAFT
REMOVE AFT SHORT TAIL ROTOR DRIVE SHAFT
OIL IN TANK?
YES
DRAIN OIL TANK
NO
REMOVE ENGINE OIL COOLER
REMOVE OIL FITTINGS AND LINES
REMOVE FLEXIBLE AIR DUCT
REMOVE FAN AND SHAFT ASSEMBLY
SHIMS BONDED TO HELICOPTER STRUCTURE?
NO
MARK OUTLINE OF SHIMS ON HELICOPTER
REMOVE SHIMS
YES
STOP

FIGURE II.3: Learning Analysis of the Task: REMOVE MAIN DRIVE SHAFT FROM OH-58 HELICOPTER

LO and LSs for TLO 3:

Learning Objective: Given an OH-58 helicopter, Technical Manual 55-1520-228-20, DA Form 2408-13, and a general mechanics tool kit, the student will remove the main drive shaft in accordance with Technical Manual 55-1520-228-20.

Learning Steps:

1. Remove cooling fan and shaft assembly.
2. Remove after fairing.
3. Remove forward short tail rotor drive shaft.
4. Remove aft short tail rotor drive shaft.
5. Drain oil tank, if necessary.
6. Remove engine oil cooler.
7. Remove oil fittings and lines.
8. Remove flexible air duct.
9. Remove fan and shaft assembly.
10. Mark outline of shims on helicopter, if necessary.
11. Remove shims, if necessary.

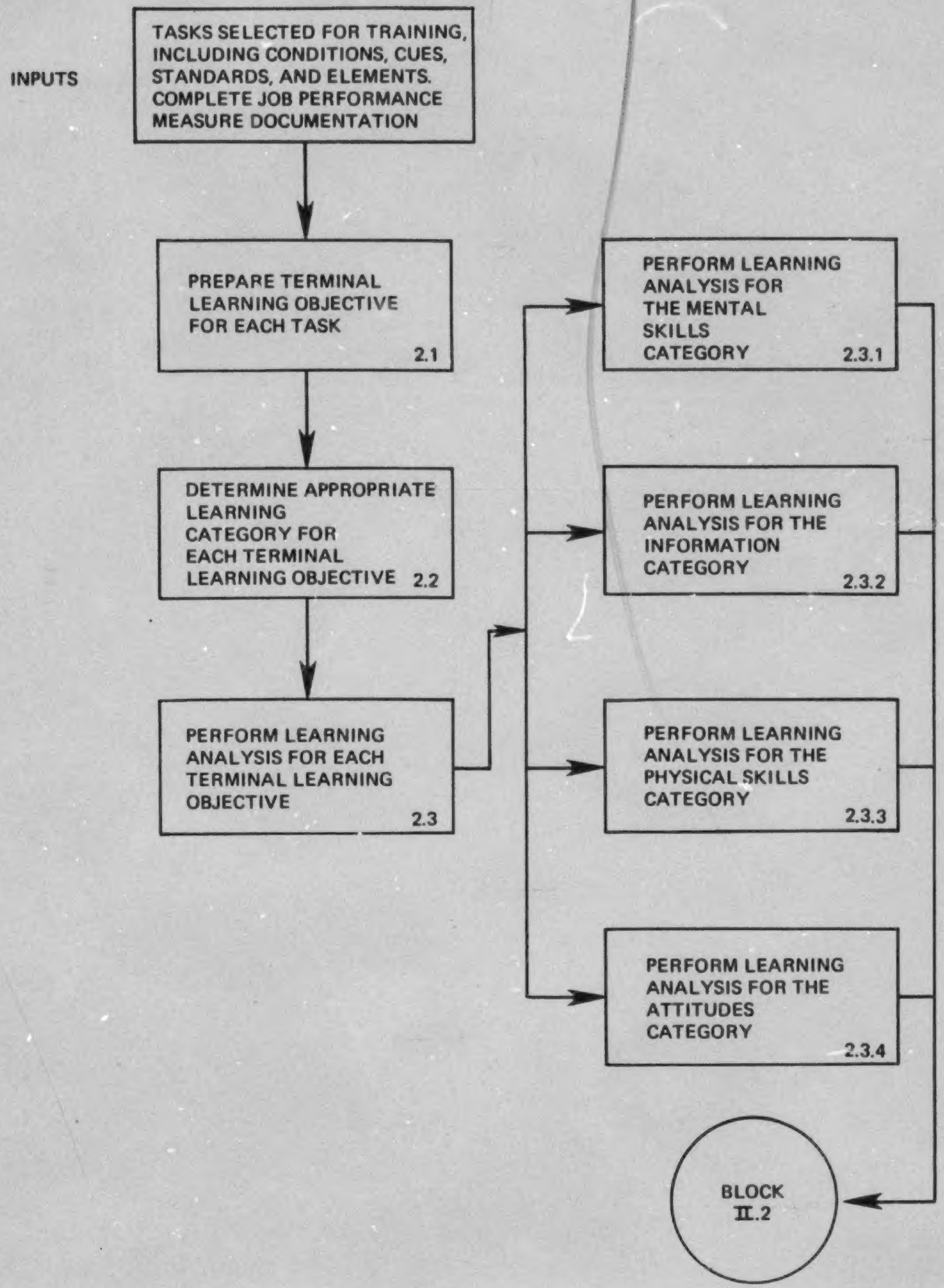
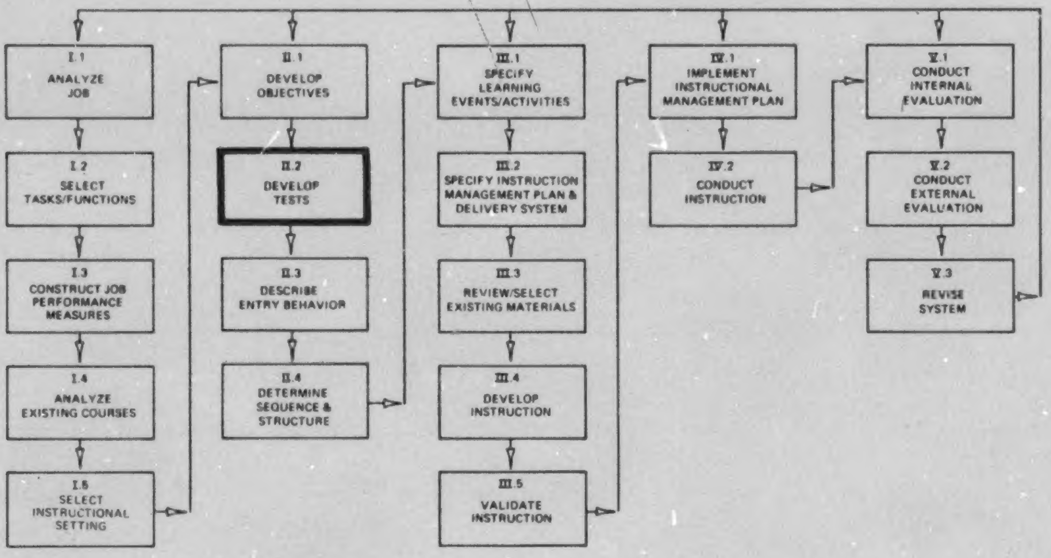

INPUTS
TASKS SELECTED FOR TRAINING, INCLUDING CONDITIONS, CUES, STANDARDS, AND ELEMENTS. COMPLETE JOB PERFORMANCE MEASURE DOCUMENTATION
PREPARE TERMINAL LEARNING OBJECTIVE FOR EACH TASK 2.1
DETERMINE APPROPRIATE LEARNING CATEGORY FOR EACH TERMINAL LEARNING OBJECTIVE 2.2
PERFORM LEARNING ANALYSIS FOR EACH TERMINAL LEARNING OBJECTIVE 2.3
PERFORM LEARNING ANALYSIS FOR THE MENTAL SKILLS CATEGORY 2.3.1
PERFORM LEARNING ANALYSIS FOR THE INFORMATION CATEGORY 2.3.2
PERFORM LEARNING ANALYSIS FOR THE PHYSICAL SKILLS CATEGORY 2.3.3
PERFORM LEARNING ANALYSIS FOR THE ATTITUDES CATEGORY 2.3.4
BLOCK II.2

FIGURE II.1: Flowchart of Block II.1: DEVELOP OBJECTIVES

BLOCK II.2: DEVELOP TESTS*


I.1
ANALYZE JOB
I.2
SELECT TASKS/FUNCTIONS
I.3
CONSTRUCT JOB PERFORMANCE MEASURES
I.4
ANALYZE EXISTING COURSES
I.5
SELECT INSTRUCTIONAL SETTING
II.1
DEVELOP OBJECTIVES
II.2
DEVELOP TESTS
II.3
DESCRIBE ENTRY BEHAVIOR
II.4
DETERMINE SEQUENCE & STRUCTURE
III.1
SPECIFY LEARNING EVENTS/ACTIVITIES
III.2
SPECIFY INSTRUCTION MANAGEMENT PLAN & DELIVERY SYSTEM
III.3
REVIEW/SELECT EXISTING MATERIALS
III.4
DEVELOP INSTRUCTION
III.5
VALIDATE INSTRUCTION
IV.1
IMPLEMENT INSTRUCTIONAL MANAGEMENT PLAN
IV.2
CONDUCT INSTRUCTION
V.1
CONDUCT INTERNAL EVALUATION
V.2
CONDUCT EXTERNAL EVALUATION
V.3
REVISE SYSTEM

OVERVIEW

Testing is used after training to determine whether or to what degree trainees learned what they were intended to learn. In addition, entry tests are used to reject people for training or to prescribe remedial training. Pretests that match the posttests are used for placement within a training program or for exempting trainees from a program, and within-course tests are used to determine trainee progress and need for assistance during the training.

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*Portions of this material have been adapted from: Swezey, R. W., and Pearlstein, R. B. Developing criterion referenced tests (287-AR18(2)-IR-0974-RWS). Reston, Va.: Applied Science Associates, September 1974.

DEVELOP TESTS

1.0 INTRODUCTION

Each terminal learning objective (TLO) is derived from a JPM. The training test for the TLO may be identical to the JPM, or there may be additional constraints in the training setting that decrease the level of fidelity of the training test. The change may be in the action, the initiating cues, conditions, or standards. Each learning objective (LO) must be tested in the training setting. For the same reason mentioned above, these tests may or may not be identical to related parts of the JPM. The learning steps (LSs) may or may not be tested individually; however, they are often tested as part of the TLO or LO test.

In the learning analysis of the TLO, many LOs and LSs may be listed. Some of these are steps in the original task or JPM; however, some of them represent other skills or knowledges that must be obtained to master the TLO. Generally, these other skills or knowledges, once mastered, are of no particular further concern to the evaluators (testers).

EXAMPLE

> Analysis of the skills needed for multiplication of three-digit numbers would yield an LO or LS stating an "addition" skill. This "addition" skill probably would be tested in an entry test, diagnostic pretest, and within-course test; however, it would not be tested separately in the TLO test at the end of training.

There are often many differences in learning a task and performing a task. The most obvious is the concentration on details required for performing even a simple action for the first time. Each step is consciously performed. After learning, the steps become more automatic.

EXAMPLE

1. Disassemble an M16.
2. Follow a pre-flight checklist.
3. Repack a parachute.

Another difference is the standard of performance. During training, the time required to perform is usually longer, the degree of proficiency is lower and the product is less than perfect.

EXAMPLE

1. Time to troubleshoot an engine malfunction
2. Quality of a sheet metal joint
3. Amount of assistance required to draw the accident scene on an SF91 report

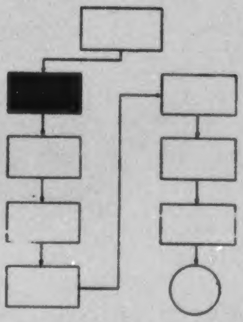
The inputs to this block are the tasks selected for training, along with their supporting documentation, the JPMs developed in Block I.3, and the TLOs, LOs, and LSs derived in Block II.1.

The procedures for developing tests are shown on Figure II.4, the fold-out page at the end of this block.

The outputs of this block include a posttest (end of training test), and as required, an entry test, pretests, and within-course tests.

2.0 PROCEDURES

2.1 Determine How Detailed the Test Should Be



How detailed and inclusive a test should be depends upon the use for which it is intended.

If the need is to place trainees in remedial courses, place them at various points within a course, or exempt them from a course, the test must be sufficiently broad to cover all the course prerequisites, entry behavior, and all the TLOs and LOs. It must be detailed enough to discriminate between those who can perform and those who cannot perform.

If the test is to be used for making an accept/reject for training decision, it should be a relatively narrow test that discriminates between those who have the necessary entry behaviors and those who do not.

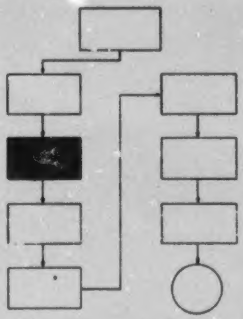
If the purpose of the test is to give trainees information on how they are progressing, the test should include test items on TLOs, LOs, and possibly LSs that can be scored either mechanically or by the student to give him feedback. This feedback can also be used to recycle the student, prescribe remedial instruction, or place the trainee ahead.

When a course is being developed there is an additional use for test results. If students are tested frequently the scores provide a record of how well the instruction is performing. Errors by students pinpoint failures in the instruction. Early achievement of goals or higher than expected standards are indications that the instruction should be shortened. Testing for validation (Block III.5) should be detailed and should have a detailed scoring procedure.

2.2 Translate TLOs and LOs Into Test Items

2.2.1 Testing Mental Skills

Mental skills can often be tested with paper and pencil tests even when the job task is not a paper and pencil task.



EXAMPLES

	LEARNING OBJECTIVE ACTION STATEMENT	TEST ITEM	
1.	Select the proper fire extinguisher for the following classes:	Select the proper fire extinguisher for the following fires:	
	a. ordinary combustible materials b. flammable liquids c. electrical fires	Fires-- paper wood rags trash grease flammable liquid electrical	Extinguishers-- water soda and acid foam CO_2 dry powder
2.	Identify US and USSR destroyers.	(Using pictures) classify the following ships as US or USSR:	
		Claud Jones Forrest Sherman Kola Riga Kotlin . .	

	LEARNING OBJECTIVE ACTION STATEMENT	TEST ITEM
3.	Identify medical service symbols.	Which of these are medical service symbols? ☐ ☐ ☐ ☐ ☐ A B C D E
4.	Visually detect camouflaged armored vehicles in a terrain setting.	Mark the location of armored vehicles in the following slides if any are in the picture. ☐ ☐ ☐ A B C
5.	Choose a diagnostic strategy for a malfunction in the main drive shaft of an OH-58.	Using the simulator for each preprogrammed malfunction, choose a diagnostic strategy for locating the problem.

In each case the answers could be written. For the same skills, there could also be performance test items.

The disadvantage of the written test items is the artificial initiation and temination cues. For instance, the real cue to select a fire extinguisher is the existence of a fire. This is a cue to determine its class then select the fire extinguisher. Similar real cues exist for classifying ships, identifying symbols, and detecting camouflaged vehicles. Rather sophisticated simulation of field exercises would be required to provide surprise initiating cues.

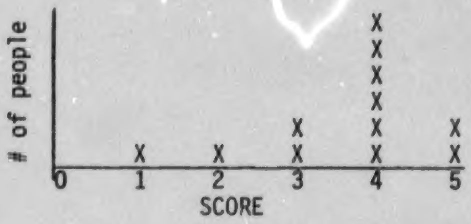
In addition, each of these mental activities, such as classify, identify, and detect, is an initiating cue to some action: Put out the fire; decide whether a ship is friendly and take appropriate action; decide whether to bomb or not bomb a building and do it; detect, identify and destroy enemy armored vehicles.

There are mental skills objectives for which there are a large number of items and those with relatively few.

Rather than having degrees of proficiency like many physical skills, mental skills are supposed to be either learned or not learned. Sometimes test scores for many people are much alike, sometimes the scores clearly divide the people into two groups, and sometimes the scores are spread rather evenly over a wide range.

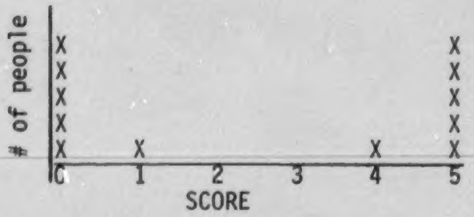
EXAMPLES

1. In the first case if the results were drawn for a five item test, they would look like this:



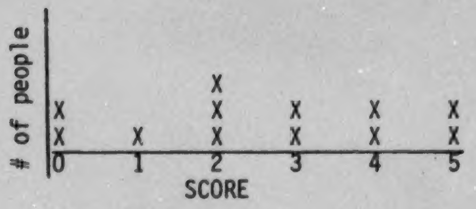
In this case, 67% of the people scored 4 or 5. The conclusion drawn is probably that those 67% have mastered the skill and the other 33% have not.

2. In the second case, if the results were drawn for a five item test, the results would look like this:



This case clearly divides people into "go" and "no-go" groups. Both of the above are reasonable patterns to get when testing mental skills.

3. In the third case, people are spread out. This pattern indicates a range of proficiency uncharacteristic of mental skills.



If results look like this, check to see if the items are all testing the same mental skill and if there are other factors, like guessing, that could be influencing the scores.

2.2.2 Testing Information

Information test items are relatively easy to develop from the learning objectives.

EXAMPLE

LEARNING OBJECTIVE ACTION STATEMENT	TEST ITEM
Describe the rules of war including forbidden targets, tactics, and techniques; treatment of captives, detainees, civilians and private property; and what to do when crimes are committed.	Describe the rules of war: include forbidden targets, tactics, and techniques; treatment of captives, detainees, civilians and private property; and what to do when crimes are committed.

The problems with testing information are in setting standards when there is no job criterion and sampling when there is too much information to be tested. In both cases the test developer makes an arbitrary decision. Either he makes the decision himself or he consults "experts" and gets a consensus. Most information is subordinate to other learning or to other performances. Although an LO that tests the information must be made, it may not be included in the TLO.

EXAMPLE

The action part of a TLO for Radio Teletypewriter Communication Procedure is: Arrange the contents of a DD Form 173 into the correct radio teletypewriter message format.

The LOs include: Listing the parts of a message, the components of the message heading and the (details omitted for simplicity). Test items on the LOs within the course require the trainee to list these parts. The TLO test item assumes that if the trainee can identify the errors and send the right error message he also knows the parts of the message, heading and address, etc.

LO test items:

1. List the three parts of a message.
   a. ______________________________
   b. ______________________________
   c. ______________________________

2. A message heading may contain four components. List them in proper order.
   a. ______________________________
   b. ______________________________
   c. ______________________________
   d. ______________________________

NOTE: Complete statements 3 through 6 by filling in the blanks.

3. The call and transmission instructions appear in the ______________________ component of the message heading.

4. The precedence, date-time-group and message instructions appear in the ___________________ component.

5. The accounting information and group designation appear in the ______________________ component.

6. The originator, action, information and exempted addresses appear in the ______________ component.

7. List the four prosigns which could appear in the address component.
   a. ____________________________
   b. ____________________________
   c. ____________________________
   d. ____________________________

2.2.3 Testing Physical Skills

When the JPMs have high job fidelity, the training tests should follow as closely as possible. The problems are likely to be in initiating and terminating cues and standards. TLO test standards must be set to match the JPM. Within course tests have to reflect realistic degrees of proficiency after each amount of training. This can be based on past experience or empirically developed with a new training program.

EXAMPLE

LEARNING SUB-CATEGORY	LEARNING OBJECTIVE ACTION STATEMENT	TEST ITEM
Performing gross motor skills (7)	Load the chaparral	Load the chaparral (Checklist)
Steering and guiding--continuous movement (8)	Guide the TOW missile to a selected target.	Guide the TOW missile to a selected target. (Checklist; number of hits)
Positioning movement and recalling procedures (9)	Assemble and disassemble the M203 grenade launcher.	Assemble and disassemble the M203 grenade launcher. (Checklist)
Voice communicating (10)	Communicate with divers at a depth of 30 meters using telephone equipment.	Send and receive messages of at least two minutes duration with divers 30 meters below the surface. (Checklist)

The initiating cues may be non-existent or considerably different at the beginning of training and added or changed in the final stages.

EXAMPLE

Learning objective in marksmanship--

Action statement: Hit a target at "x" meters.
Beginning initiating cues: When instructor says, "fire," fire.
Conditions: Official paper target with concentric circles.
Standards: Score above _XX_.

The JPM from which the marksmanship LO was derived might have included the initiating cues and target of "punchy Pete," and standards of "hit so that punchy Pete falls down."

2.2.4 Testing Attitudes

How the trainee feels about something cannot be measured directly. While he can be asked directly, he may or may not tell his real feelings. But what is more important is how he behaves. When a learning analysis was done of an attitude, items were listed that would be acceptable as evidence that the desired attitude had been learned. This evidence must be translated into a test or a checklist.

EXAMPLE

Learning Objective: Radio operator will have a protective attitude towards his equipment:

1. he keeps battery and battery case free from corrosion
2. He keeps the components properly attached or correctly stored.
3. He performs regular maintenance.

Test item possibilities:

A. Ask the trainee

1. Do you protect your equipment?

   Yes No

2. Do you keep the battery and battery case free from corrosion?

   Always Usually Rarely

3. Do you keep the components properly attached or correctly stored?

   Always Usually Rarely

4. Do you perform regular maintenance?

   Always Usually Rarely

B. Supervisor observes and scores trainee

1. Are his battery and battery case free from corrosion?

   Yes No

2. Are the components properly attached or correctly stored?

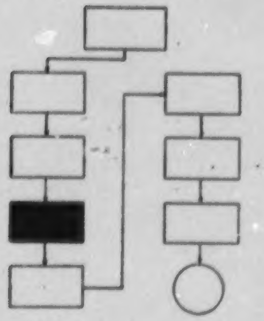
   Yes No

3. Has regular maintenance been performed?

   Yes No

The answers in "A" will probably be influenced by the trainee's perception of what you want him to answer. The answers in "B" reflect the condition of his equipment at a point in time and the presence of evidence selected on which to judge his attitude.

2.3 Set Training Standards



When the trainee is on the job, his standard should equal the job standard. From the beginning of training until he is on the job, the standards may be different from the job standard. There may be a gradual increase in the standard through training. It may even reach a level higher than that required on the job to allow for some skill decay during the lag between training time and job performance.

Some job standards, such as those for using hand grenades, are very specific and cannot be changed. But, for training, dummy grenades could be used until those standards are met.

The end-of-training standard should approximate the JPM standard. Within-training standards should be based on reasonable expectations after given amounts of time in training. They should be low enough to be attainable and high enough to be an interesting challenge to the trainees.

EXAMPLE

> At the end of two weeks of senior life saving instruction, a physically fit graduate must swim one mile. The standard for the end of the third day might be 100 yards.

At times there are no real job standards and the TLO test standards should match the JPM standards as closely as practical.

EXAMPLE

Task: In combat, observe the customs and the laws of war as presented in the Geneva Convention and Hague Regulations in the following areas:

A. Forbidden targets, tactics and techniques
   1. Do not attack noncombatants
   2. Preserve cultural and humanitarian property
   3. Protect medical personnel and facilities
   4. Do not hide behind the medical service symbols.

B. Enemy captives and detainees
   1. Let enemy soldiers surrender.

.
.
.

JPM: In a set of simulated field exercise problems, observe the customs and laws of war as presented in the Geneva Convention and Hague Regulations with no more than one error in six problems in the following areas:

A. Forbidden targets, tactics and techniques
   1. Do not attack noncombatants
   2. Preserve cultural and humanitarian property.
      . (same as job task above)
      .
      .

In some training settings, simulated field exercises may not be practical. The TLO may have a low physical fidelity to the task/JPM.

EXAMPLE

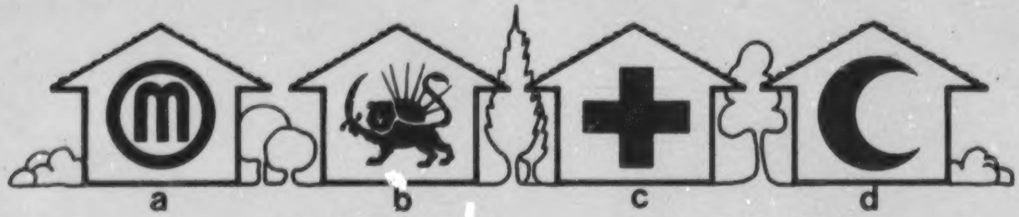
TLO:
Action: Apply the customs and laws of war as presented in the Geneva Convention and Hague Regulations in the following areas:

A. Forbidden targets, tactics and techniques
   1. Do not attack noncombatants
   2. Preserve cultural and humanitarian property.
      .
   4. Do not hide behind the medical service symbols.

Condition: Given a written set of simulated problems.
Standard: No more than one error in six problems.
TLO Test: (A4 only) Do not hide behind the medical service symbols.

Test item:

You are in a village and have been cut off from your squad. Which building(s) may you use for cover?



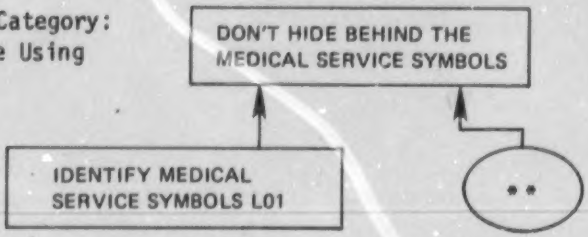
In a war, the job task standard would be that combatants are not supposed to violate any laws of war. In both the JPM and the TLO test, the task standard is not applicable. Since the TLO test is a written exercise, there is no external criterion; therefore set an arbitrary standard.

For many LOs there will be no external criterion.

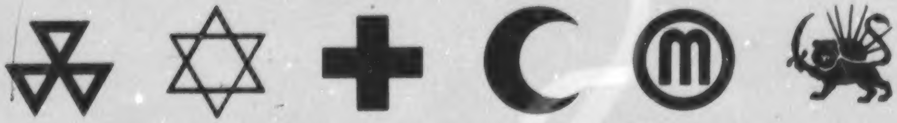
EXAMPLE

Sub-Category:
Rule Using

Learning Analysis of A4


DON'T HIDE BEHIND THE MEDICAL SERVICE SYMBOLS
IDENTIFY MEDICAL SERVICE SYMBOLS L01
**

L01 test: Which of these symbols are medical service symbols?



> To set the standards for this LO, you may decide whether all medical service symbols must be identified as such or if it is acceptable for the learner to select A and E which are not medical service symbols. While the latter is an error, it is one that does no harm.

Standards may also be set by consensus. There is no known job standard for LOs such as, "An E-2 should be able to recall the Code of Military Justice." When the question is "how much" should he be able to recall, the usual feeling is that "more is better." A standard can be set for this by consensus. Have experts or supervisors specify just what an E-2 needs to be able to recall. Or, test E-2s who are identified as knowing what they need to know and use their scores as a standard. Neither of these methods is very satisfactory and should only be used as a last resort.

2.3.1 False Positives and False Negatives

One purpose of testing is to separate those who can perform the learning objectives from those who cannot. Since tests are not perfect--there are external factors that cannot be controlled; the trainers may have a bad day or the test monitor or scorer may make a mistake--people are sometimes misclassified. If a person cannot perform the task but he passes the test, he is called a false positive. If he can perform the task but fails the test, he is called a false negative. Figure II.5 shows these classifications along with the "correct" classifications.

	pass test	fail test
can do task	correct	false negative
cannot do task	false positive	correct

FIGURE II.5: False Positives and False Negatives

The goal is to develop tests and scoring procedures to make the fewest possible misclassifications. However, there are times when one of the errors is more serious than the other.

EXAMPLE

> In the case of a dangerous task such as mine sweeping, it would be less costly in terms of risk to people and property to fail a trainee who could adequately perform the job (therefore, making him a false negative), than it would be to pass someone who really could not perform the task (a false positive).

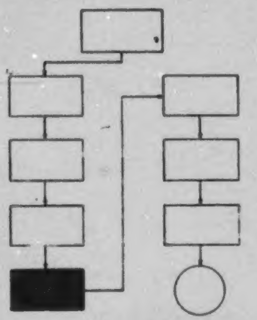
Sometimes a change in standard will reclassify trainees from a fail to a pass.

EXAMPLE

> A trainee cook may fail the test because he is slow. With a little time on the job, he would be an adequate cook. If cooks are desperately needed, you may wish to change the test standard.

Set the test standards to minimize both false positives and false negatives. If there is a risk or price attached to one or the other, minimize the one with the high risk or high cost associated with it, at the expense of the other.

2.4 Rank Order Students (If Required)



Tests associated with the ISD process are primarily intended to indicate whether or not a student has achieved a specified level of mastery. Therefore, emphasis has been on procedures for constructing tests which accurately indicate student performance of carefully defined behaviors. However, sometimes there is a need to assign ranks to students. That is, sometimes the top 5% of your graduates must be identified, or the students listed in order of their achievement, or some other type of report must be presented which reflects an ordering of the students. If JPMs have been used to develop the tests, the tests and scoring procedures developed may not allow for efficient rank ordering.

For example, if the test has four out of five correct as its passing score and the entire class passes the test, there is no basis for rank ordering the students. There are alternate procedures that can be used to obtain ordered student data; however, a most important point is that tests are designed to do something, and if they are used inappropriately, they may not work well. So, if measuring absolute performance is important, design a test to do that, but if rank ordering students is important, design a test to do that.

Good rank order tests have many of the same characteristics as tests designed to indicate a specific set of abilities. For example, construction of rank order tests requires the same definition of what is to be tested and the same concern for the mechanics of test directions, test administration, scoring, and the like. The concepts of test reliability and validity must be maintained. Rank order tests are different in that they are designed to produce a distribution of scores; that is, if ten individuals take the test, there likely will be ten different scores.

Rank ordering is appropriate when there is a need to select the fastest, the most accurate, or the best producer.

EXAMPLES

1. If you need the best marksmen, rank order the trainees on the basis of their marksmanship test or on punchy Pete.
2. If you want the best golfers, rank them from low to high scores.
3. If you want the best runners, rank them from shortest to longest times.
4. If you want the best radio teletype operators, rank them on the basis of speed and accuracy.

In each of the above cases scores can be assigned to the performance. In some cases there is an existing criterion. It may be that radio teletype operator trainees who cannot type at 20 words per minute at the end of two weeks will not reach the minimum acceptable level by the end of training and those who type faster will be better on the job. If this were so you would have a criterion.

In other cases there is no discernable criterion.

EXAMPLE

Suppose that a test on the Universal Code of Military Justice's major 25 points was given to everyone in the Armed Forces. While it is only a guess, it is probably safe to say that the distribution of scores might look like this:

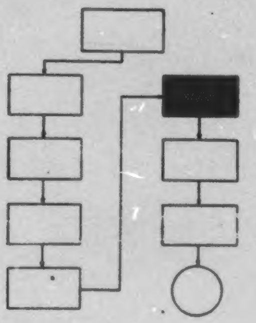
Score	Frequency
25	X
24	XX
23	XXX
22	XXX
21	XXXX
20	XXXXX
19	XXXXXX
18	XXXXXXX
17	XXXXXXXXX
16	XXXXXXXXXXX
15	XXXXXXXXXXXX
14	XXXXXXXXXXXXX
13	XXXXXXXXXXXXXX
12	XXXXXXXXXXXXX
11	XXXXXXXXXXXX
10	XXXXXXXXXXX
9	XXXXXXXXX
8	XXXXXXX
7	XXXXXX
6	XXXXX
5	XXXX
4	XXX
3	XXX
2	XX
1	X

How many questions does a military person need to answer correctly in order to advance in rank, have a successful career, perform his primary mission, or be a credit to the service? This is one of those dangerous, criterionless situations in which it is tempting to say, "More! They should know more." If the person scores well on the test, must he continue to take the instruction?

While it is possible to express scores on this test as the percentages of correct responses out of the total number of possible responses, and to decide, for example, that everyone who gets 75% passes, this cut-off score is arbitrary since it is not based on any established criterion. It is also possible to rank order the students and pass the top 75%. This alternative is as good--or bad--as the first since it is not known how high the scores should be. Being arbitrary by any other name is still being arbitrary, and arbitrary criteria should be recognized as such.

2.5 Set Cut-Off Scores

When a cut-off score is set, such as 70 percent or 8 out of 10 questions correct, how many items are correct must be related to which items were correct. Often, getting LOs correct does not guarantee getting the TLO correct, and the TLO is what counts. Also, the TLO may include the LOs.



EXAMPLE

Test item 1-LO1: List the three parts of a message.

Test item 2-LO2:

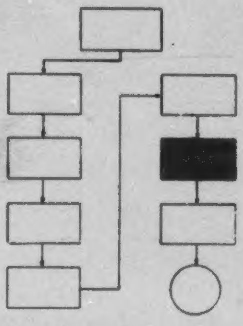
.
.
.

Test item 9-LO9: List the prosign meaning "break" that is used on the separation lines on the radio teletypewriter message form.

Test item 10-TLO: Transfer information from the joint message form (DD Form 173) to a blank sheet of paper and arrange the content of the message heading in the proper format for transmission.

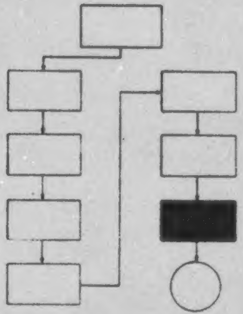
The TLO and its test item match the JPM. Only if the student can pass the TLO test item can he do the job. Reaching an 8 out of 10 criterion on the 10 item test is meaningless if the TLO item is not one of those done correctly. Only a pass on the TLO test item means "go." The scores, in this case, on the LO test items can be used to help find where the trainees had problems in the lesson so remedial instruction can be provided or the instruction can be revised. The LO scores should not be used for a "go/no-go" decision.

2.6 Determine Scoring Procedures



Once all the test items are completed, the next step is to carefully document the procedures for administering the tests and scoring the tests. Any special equipment, facilities, test administrator skills, or other resources must be listed.

2.7 Collect Baseline Data



If there is existing instruction for the DOS, the TLO tests developed in this block should be administered to all or a large sample of individuals who have just completed the existing instruction. This will serve two purposes.

1. It will provide an opportunity to try out the test items and administration procedures. If there are obvious problems, these can be used as a basis for making revisions in the test items or the administration procedures.
2. It will provide baseline data that can be used in Block V.1 for conducting internal evaluation.

Background and training information should be collected on graduates used in the test trial, since wherever possible, these same graduates will be included in the later external evaluation.

3.0 OUTPUTS

The outputs of this block should be:

3.1 Products

1. Test items for each TLO, LO and LS. (The LS tests will often be included in the LO tests.)
2. Test items organized into entry tests, pretests, within-course tests, and posttests. (Finalizing these tests must be accomplished after structuring of learning objectives in Block II.4.)

3.2 Other Documentation

1. A summary statement of baseline data from test trials.
2. Any critical decisions made in accomplishing the above and the rationale for the decisions.

EXAMPLES

1a. Performance test or real problem requiring signalman to pick a draft from a hold, or between deck, and deposit it on the pier. Present simulated loading problem (number and size of the cargo should be listed for the test administrator.) Student must direct winch operator using the correct hand signals. (Time limits and other standards will be determined by the problem)

1b. Information test:

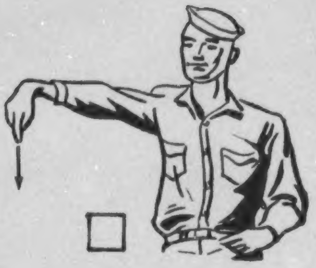
LO: Give and respond to correct hand signals for operation of winches for: Lower the hook
Raise the hook
.
.
.
Hold everything

An entry test might include recognition of the hand signals such as: Match the hand signals with the message by printing the correct letter by each picture--

A. Lower the hook

B. Stop

C. Lower the boom
.
.
.
L. Rack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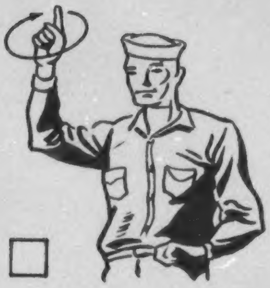
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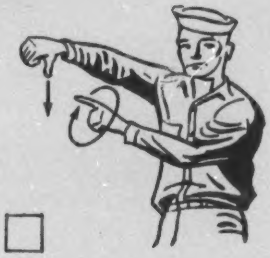
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Students who passed the information test would then be given the performance test.

2. Starting from a change in a job (Recruiter whose duties have changed due to the expiration of the draft), this example samples from a study done for the Army Recruiting Command.* Job analyses were done for the Recruiter, Recruiting Manager, and all the jobs through the command.

Recruiting Manager--

Goal: Perform supervisory duties.

TLO: Review follow-up procedures on all applicants processed by the AFEES. Evaluate individual recruiter's follow-up technique. Given case studies of follow-up techniques employed by each assigned recruiter and corresponding completed prospect cards with varied disposition entries, e.g., enlisted, qualified not enlisted (QNE) and disqualified (mental-temporary, mental-permanent, physical-temporary, physical-permanent, and moral), the student will evaluate each recruiter's follow-up technique to identify deficiencies. Acceptable performance will include correctly identifying all deficiencies in each recruiter's follow-up technique.

Test Items: (What must the learner be able to do to perform the task? Or, what knowledge and skills will enable the learner to perform?)

a. Describe the purposes of follow-up (Attachment #1)

b. Describe follow-up techniques:

   1) Letters
   2) Phone calls
   3) Making or inviting visits

c. Describe techniques for counseling applicants disqualified at the AFEES:

   Given a portrayal of an applicant who has been medically or mentally disqualified, the recruiter will:

   1) Make a statement of understanding or sympathy concerning the applicant's disqualification.

---

*This has been adapted from: Sugrue, E. D. (Project Director). Turning point: An evaluation of the professional skills needed to support the continued growth of the Volunteer Army. Boston, Mass.: Harbridge House, Inc., 1974.

2) Discuss the applicant's mental test score compared to the minimum acceptable (if applicable).
3) Discuss the probabilities for a (mental) retest (if applicable).
4) Summarize the medical disqualification (if applicable).
5) Explain possible remedial action, if any (if applicable).

Attachment #1--

1. Enlisted:

   a. Identification of new leads (individual becomes a center of influence (CI)).
   b. Enhance favorable Army image.

      1) Insure individual gets what he was guaranteed (option, assignment).
      2) Offer asssitance during his basic and advanced training phases.

2. Qualified, not enlisted (QNE):

   a. Identification of new leads.
   b. Determine reason for not enlisting.
   c. Get the individual to reconsider (react to reason).

3. Disqualified:

   a. Identification of new leads.
   b. Eliminate negative opinions.
   c. If disqualification is temporary, assist the individual in attempting to eliminate the disqualification.
   d. Maintain contact in the event regulatory changes eliminate the disqualifier.

NOTE: Individual disqualified for moral reasons (e.g., police record) are not normally a subject of follow-up actions.

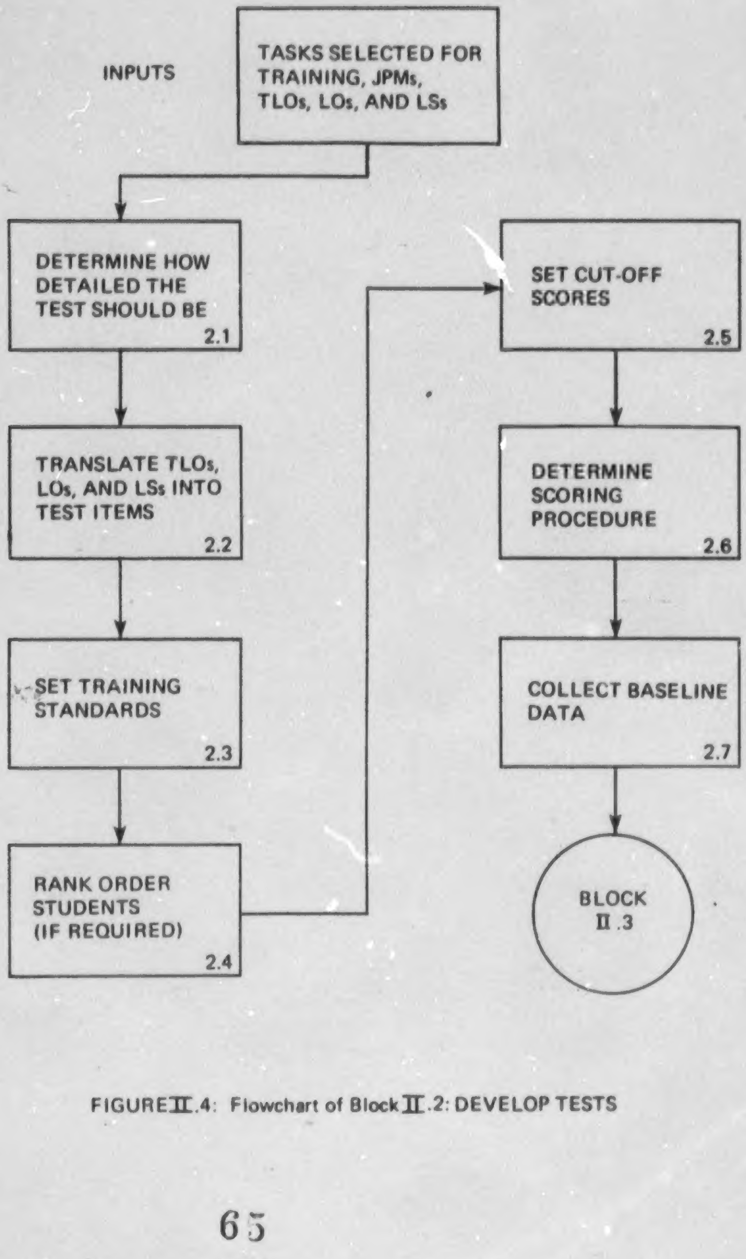
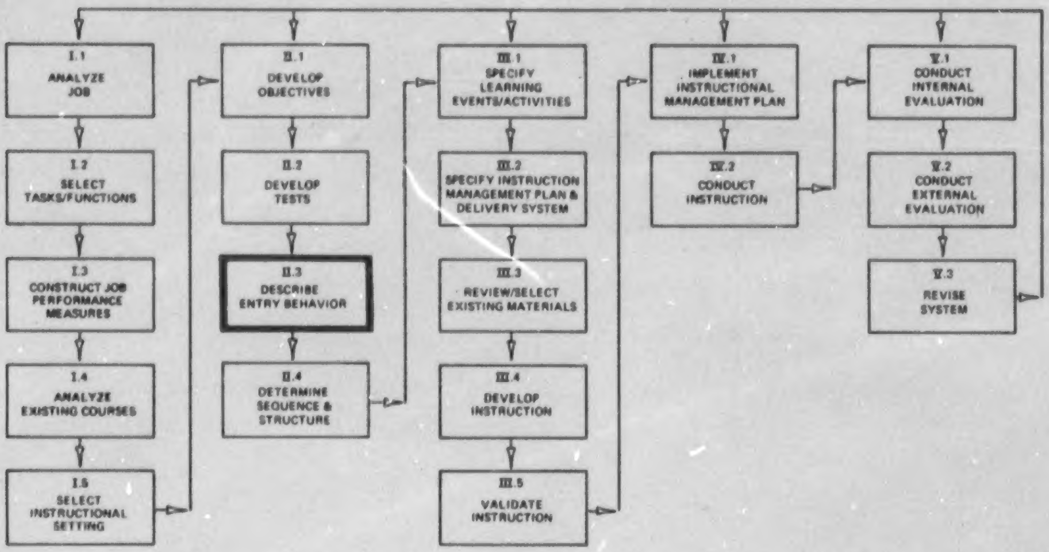

INPUTS
TASKS SELECTED FOR TRAINING, JPMs, TLOs, LOs, AND LSs
DETERMINE HOW DETAILED THE TEST SHOULD BE 2.1
TRANSLATE TLOs, LOs, AND LSs INTO TEST ITEMS 2.2
SET TRAINING STANDARDS 2.3
RANK ORDER STUDENTS (IF REQUIRED) 2.4
SET CUT-OFF SCORES 2.5
DETERMINE SCORING PROCEDURE 2.6
COLLECT BASELINE DATA 2.7
BLOCK II.3

FIGURE II.4: Flowchart of Block II.2: DEVELOP TESTS

BLOCK II.3: DESCRIBE ENTRY BEHAVIOR


I.1 ANALYZE JOB
I.2 SELECT TASKS/FUNCTIONS
I.3 CONSTRUCT JOB PERFORMANCE MEASURES
I.4 ANALYZE EXISTING COURSES
I.5 SELECT INSTRUCTIONAL SETTING
II.1 DEVELOP OBJECTIVES
II.2 DEVELOP TESTS
II.3 DESCRIBE ENTRY BEHAVIOR
II.4 DETERMINE SEQUENCE & STRUCTURE
III.1 SPECIFY LEARNING EVENTS/ACTIVITIES
III.2 SPECIFY INSTRUCTION MANAGEMENT PLAN & DELIVERY SYSTEM
III.3 REVIEW/SELECT EXISTING MATERIALS
III.4 DEVELOP INSTRUCTION
III.5 VALIDATE INSTRUCTION
IV.1 IMPLEMENT INSTRUCTIONAL MANAGEMENT PLAN
IV.2 CONDUCT INSTRUCTION
V.1 CONDUCT INTERNAL EVALUATION
V.2 CONDUCT EXTERNAL EVALUATION
V.3 REVISE SYSTEM

OVERVIEW

A learning analysis was performed on each task in Block II.1 to the point of assumed entry behavior. It is time to test these assumptions, and make any necessary corrections. The entry behavior of the students defines the limits of the instruction and any required remedial or preparatory lessons. A decision is made as to whether a pretest will be used to gate students around any of the instruction that they have already mastered. If this decision is affirmative, the pretest is developed here.

DESCRIBE ENTRY BEHAVIOR

1.0 INTRODUCTION

Entry behavior includes the skills, information, and attitudes that an individual possesses at the time he comes for instruction. An instructional program assumes that students who begin instruction will already have certain skills, knowledge, and attitudes. The primary purpose of this block is to establish exactly what these entry level behaviors are. One goal of efficient, effective instruction is to base new learning on what the students already have, and to avoid having them waste time on objectives they have already mastered.

Since the entry behaviors of individuals may vary greatly, it is not always practical to start instruction at the point that matches the behaviors of all prospective students. This means some individuals should either be rejected or given remedial lessons.

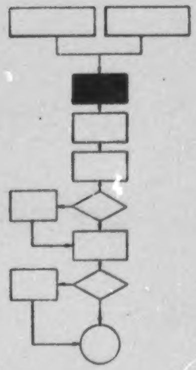
Usually the entry level is set at a point where most prospective students have the prerequisite skills, knowledge, and attributes. In Block II.1, you made assumptions about these entry behaviors. Now it is time to test those assumptions by measuring the performance of a group of individuals who are representative of trainees who will take the instruction after it is developed.

The assumptions made about student entry behavior were based on familiarity with the general level of skills, knowledge, and attitude of trainees admitted to the particular DOS, and on external systems requirements. These external requirements are statements of minimum entry behaviors usually established by the personnel system. These requirements exclude from all or certain courses of instruction individuals who do not meet minimum service-wide or specific-assignment requirements. Some of these external requirements are as follows:

1. Administrative requirements which involve personnel compliance with regulations and states. A trainee's rank, security clearance, time remaining in the service, or past criminal record may exclude him from certain types of training.
2. Physical requirements which include specific skills and general fitness which may include age, height, color perception, night vision, etc.
3. Academic requirements which include educational or aptitude considerations, specific courses, academic degrees, foreign language fluency, etc.

The inputs to this block are the learning objectives and tests developed in Blocks II.1 and II.2, and a statement of the external entry behavior requirements. The procedures are shown on the flowchart in Figure II.6 (the fold-out page at the end of this block). The outputs will include a revised or verified list of learning objectives and their tests, an entry test if required, and a pretest if required.

2.0 PROCEDURES



2.1 Test Sample of Population

In the learning analysis in Block II.1, analysis of each learning objective was continued to the point that it was assumed the intended learners had already, without training, mastered the objective. In Block II.2, test items were prepared for each of these objectives. The first step in this block is the use of these test items to test a representative sample of individuals from the target population of students. The test should be given to a large enough group to have confidence in the results. A group of 25-30 students should be sufficient, particularly if they are randomly selected from the target population. The test should be given and the results recorded.

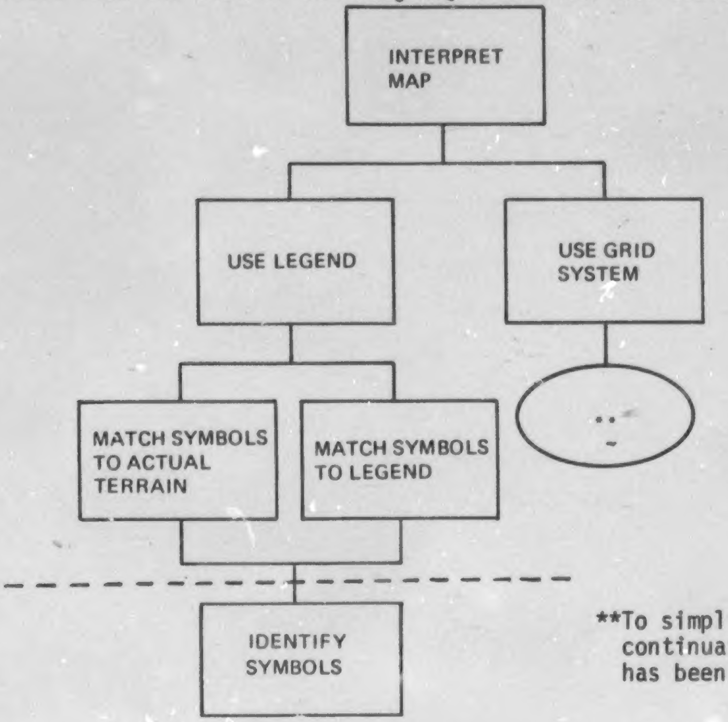
A portion of the output of Block II.1 might look like Figure II.7. For simplicity, only the action portion of the learning objectives is shown. In Block II.1, the objectives above the dotted line were assumed to be taught and those below the line were ones the students could already master.

After testing a sample group of students, the test results might look like:

Identify symbols	pass
Match symbols on map to legend	fail
Match symbols on map to actual terrain features	fail
Use legend	fail

Use grid system	fail
Interpret map	fail

If so, the original assumptions were correct, and the learning objectives and corresponding test items do not require modification. In this case, the original plan would be followed and "identify symbols" would be excluded from the list of learning objectives for the course.


INTERPRET MAP
USE LEGEND
USE GRID SYSTEM
MATCH SYMBOLS TO ACTUAL TERRAIN
MATCH SYMBOLS TO LEGEND
IDENTIFY SYMBOLS

**To simplify this example, continuation of this item has been omitted.

FIGURE II.7: Example of Part of A Learning Analysis

If the results were:

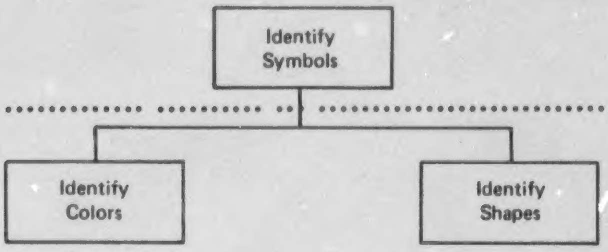
Identify symbols	fail
Match symbols on map to legend	fail
Match symbols on map to actual terrain features	fail

Use legend	fail
Use grid system	fail
Interpret map	fail

then the entry level of the students was overestimated and the learning analysis was not carried far enough. Now the analysis must be continued by asking the question "What does the student have to be able to do to master this objective?"

Identify
Symbols

Probably the analysis would result in:



When the additional learning analysis is continued to the point that the students can already master the lowest level of objectives, give the test again to a new group of students.

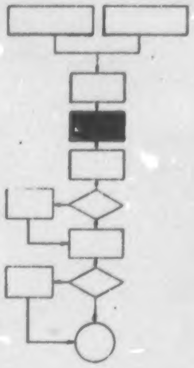
If the results were:

Identify symbols	pass
Match symbols on map to legend	pass
Match symbols on map to actual terrain features	pass

they already know. However, identifying a small percentage of unusually proficient individuals and developing training that will exclude them from a few activities may cost more than the potential savings. Objective "6" certainly fits this latter category. It should be trained to all students.

Another way of solving the problem of differences in the students is to design the instruction for most of the students, but also design some preparatory or remedial instruction for those who do not have some of the entry skills. In the example, one would not include "identify symbols" in the lesson, but would make a remedial lesson for such learning objectives that only a few needed. This plan may appear identical to the preceding one which permitted unusually proficient individuals to skip certain objectives. However, there are some important differences that will be described in other sections in this block.

2.2 Revise Learning Objectives and Tests if Required



If testing of a sample of the student population shows some of the original entry behavior assumptions to be wrong, go back to Blocks II.1 and II.2, make the necessary revisions to the learning objectives and tests, and if new objectives were added, try out the revised product on a new group of students. This revise/test procedure must be repeated until there is a good match between learning objectives and the entry behavior of the prospective students.

Use legend	pass
Use grid system	pass
Interpret map	pass

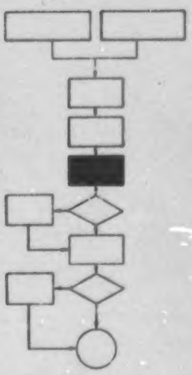
then the students' skills were underestimated. None of these objectives should be included in the learning objectives. While you will not have to reanalyze objectives or give additional tests, you will need to modify the original plans by deleting these learning objectives and their corresponding test items.

A more likely test result for 30 student is:

	Pass	Fail
Identify symbols	20	10
Match symbols on map to legend	15	15
Match symbols on map to actual terrain features	15	15
Use legend	10	20
Use grid system	6	24
Interpret map	1	29

Now the problem is more complicated. Most students can "identify symbols" but 33% cannot. Should you include it and waste the time of 67% of the students or not include it and lose the 33%? Neither, if possible. A better plan is to include the learning objective, but plan for those who can already master it to skip ahead to what they cannot do, and have training for this objective available for the 33% who need it. The same is true for the objectives "2," "3," and "4." But for objective "5," determine whether to have the six students who can already "use grid system" go through the whole lesson. It is usually best not to use training resources and time to train people on what

2.3 Determine Need for an Entry Test



An entry test is not required if the external entry requirements of the system equal or exceed the entry requirements of the course.

EXAMPLE

After making the final revision to the learning objectives and testing these on a group of 30 students, a portion of the final results might look like this: (This is a different example from the one used earlier.)

Learning Objective	Pass	Fail
1	30	0
2	30	0
3	30	0
4	22	8
5	19	11
6	14	16
7	8	22
8	5	25
9	1	29
10	2	28

If the entry behavior assumptions were that entering students mastered the first three objectives but not the others, you now will have test data to show that those assumptions were correct. Furthermore, if analysis of the external requirements (external requirements were discussed in the introduction to this block) indicate that all entering students are likely to be able to master the first three objectives, there is no need for an entry test so long as the external requirements remain unchanged. If the first learning objective above requires reading at the fourth grade level, and the personnel system requires a high school level of education for entry into the DOS, an entry test to check reading level is probably not needed.

More likely the external entry requirements, which are usually designed only to be general personnel screening instruments, will be too general to indicate whether students will meet the entry requirements for specific instruction. This is particularly true of advanced technical courses. More likely you will need an entry test and will have to make decisions as to what action to take with entering students who fail parts of the test.

EXAMPLE

After making the final revisions to your learning objectives and testing these on a group of 30 students, the results are more likely to look like:

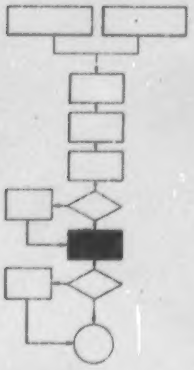
Learning Objective	Pass	Fail
1	28	2
2	27	3
3	29	1
4	25	5
5	20	10
6	15	15
7	12	18
8	5	25
9	0	30
10	0	30

Assuming that the course will include the last six objectives but not include the first four objectives, an entry test will be required for use in identifying students who do not have the required entry behaviors, and in identifying the particular areas where individual students fail to meet the entry requirements.

In the above example, a decision also must be made as to what action to take with students who fail to meet the entry requirements for the course. The alternatives are:

1. Suggest that the personnel section change the external requirements for entry into the DOS. There are several

2.5 Determine Requirement for a Pretest



While you probably will develop some kind of pretest for use in obtaining more meaningful internal evaluation data in Block V.1, you may or may not require a pretest as a permanent part of the course. Other than for internal evaluation purposes during the development/evaluation stages of the course, there are two reasons for using a pretest. These are:

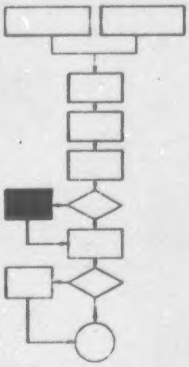
1. To determine if entry behavior of students has changed over time. While the entry test discussed earlier will reveal a decrease in incoming students' abilities, it ordinarily cannot reveal an increase in abilities. Since the pretest tests the entire course, it will show up any increases in the number of incoming students who have already mastered parts of the instruction. If this were the only reason for giving the pretest, and if the test was lengthy, a good decision might be to use the pretest periodically rather than for all incoming students.
2. To determine which parts of the instruction certain students have already mastered, so as to assign individuals to only those parts they need to learn. This can result in a considerable savings in instructional resources and students' time.

disadvantages to this. The suggestion may be denied. Even if it is not denied, much time and effort probably will be required before the change will be made--time and effort that might be spent more profitably developing better instruction. And finally, such suggestions tend to present a negative picture of the capabilities of the training establishment.

2. Assume from the beginning that some students will not pass the course. This has the disadvantage of wasting training resources and student's time; however, it may be the only alternative if time for training is severely limited. These decisions must be made by managers aware of the total training problem.
3. Prepare remedial lessons to correct the student's deficiencies before they begin the course. While this will require additional training resources, it usually is the best solution.

2.4 Develop Entry Test

Details of test development are given in Block II.2. Since test items have already been developed for each learning objective, the effort here is primarily one of selecting and organizing the test items. Generally, only the objectives that the intended students must have mastered in order to begin the course are included in the entry test.



This type of trainee assignment is difficult to achieve when instructional flexibility is limited. Many courses are offered only in the group block schedule mode. Here all students are exposed to the same instruction at the same time. One way that pretest can be used in such situations is illustrated in Figure II.8 below.

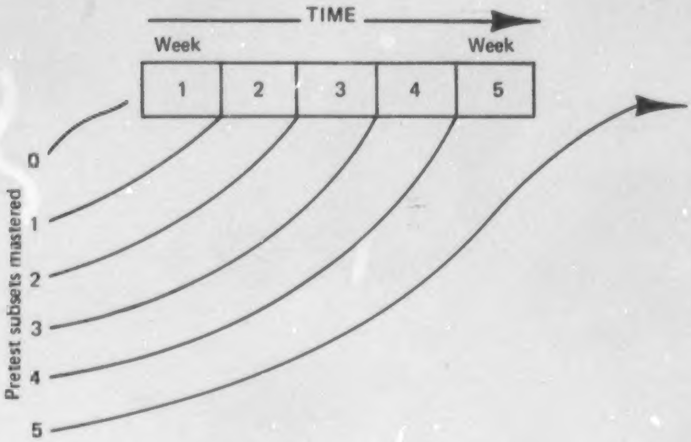
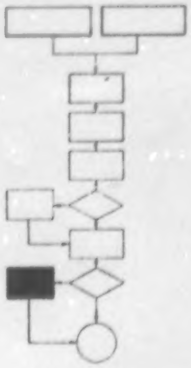


FIGURE II.8: Use of Pretest Results to Schedule Entry Into Course

This course is five weeks long. The pretest is divided into five subsets, each including the objectives from a single week of instruction. All students will take the pretest and exempt any week of instruction that their scores indicate they have already mastered. A student who obtains a passing score on subsets "1," "2," and "3," might begin coursework with the group currently in the fourth week. A student who passes the entire test may exempt the whole course.

There are no fixed rules for when to use a pretest. If a large majority of students fail all items on the pretest, the potential savings in not requiring students to restudy what they already know probably is less than the cost of testing. In such a case, a pretest should not be used as a regular part of the course. Occasionally pretesting is impractical because of resource constraints where special facilities are required. If there is doubt as to the advisability of using a pretest, the best decision probably is to use it, at least until experience shows that it serves no useful purpose.

2.6 Develop Pretest



The pretest generally is either identical to the posttest developed in Block II.2 or an alternate version of that test. If the posttest is unusually lengthy or requires use of scarce resources, the pretest may be a less detailed version of the posttest. Details of test development are given in Block II.2. The effort in this block is primarily one of selecting and organizing the test items, and determining what action will be taken when specific items on the pretest are passed by students taking the test.

3.0 Outputs

The outputs of this block should consist of:

3.1 Products

1. Learning objectives and tests revised to match entry behavior of students.
2. Entry test if required.
3. Pretest if required.

3.2 Other Documentation

1. Summary statement of testing activities and changes made as a result of testing.
2. Rationale for decision on whether to use an entry test.
3. Rationale for decision on whether to use a pretest.

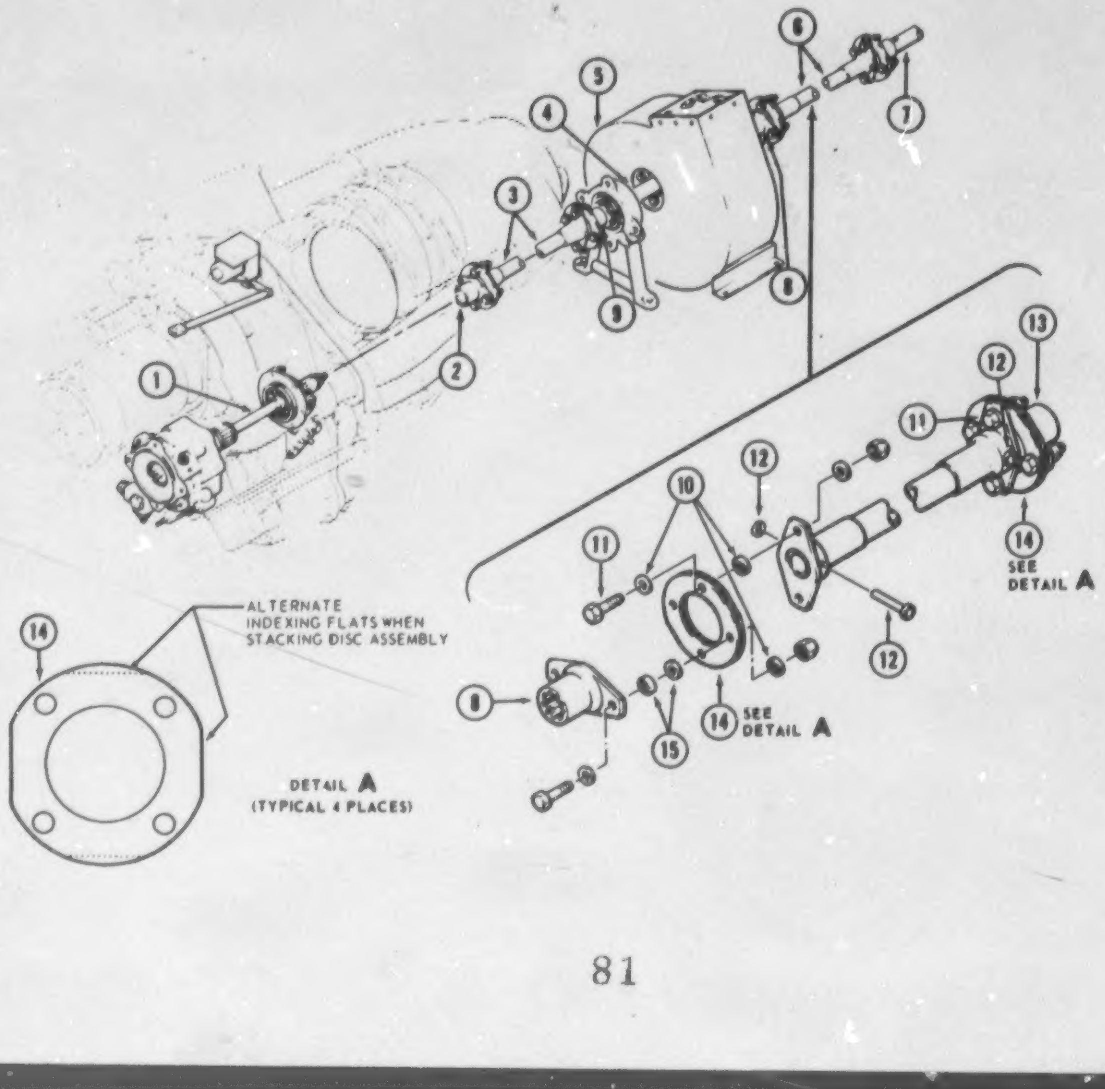
EXAMPLE

The entry behaviors for the "remove main drive shaft from OH-58 helicopter" learning objective described in Block II.1 (page 33) include:

a. identifying parts
b. identifying tools
c. selecting correct tools for specific purposes
d. using tools
e. reading procedures
f. using diagrams and schematics

A sample test item would be:

Identify the numbered parts in the diagram:


6
5
7
4
3
8
9
2
1
13
12
11
12
10
14
SEE DETAIL A
11
12
14
ALTERNATE INDEXING FLATS WHEN STACKING DISC ASSEMBLY
8
14
SEE DETAIL A
15
DETAIL A (TYPICAL 4 PLACES)

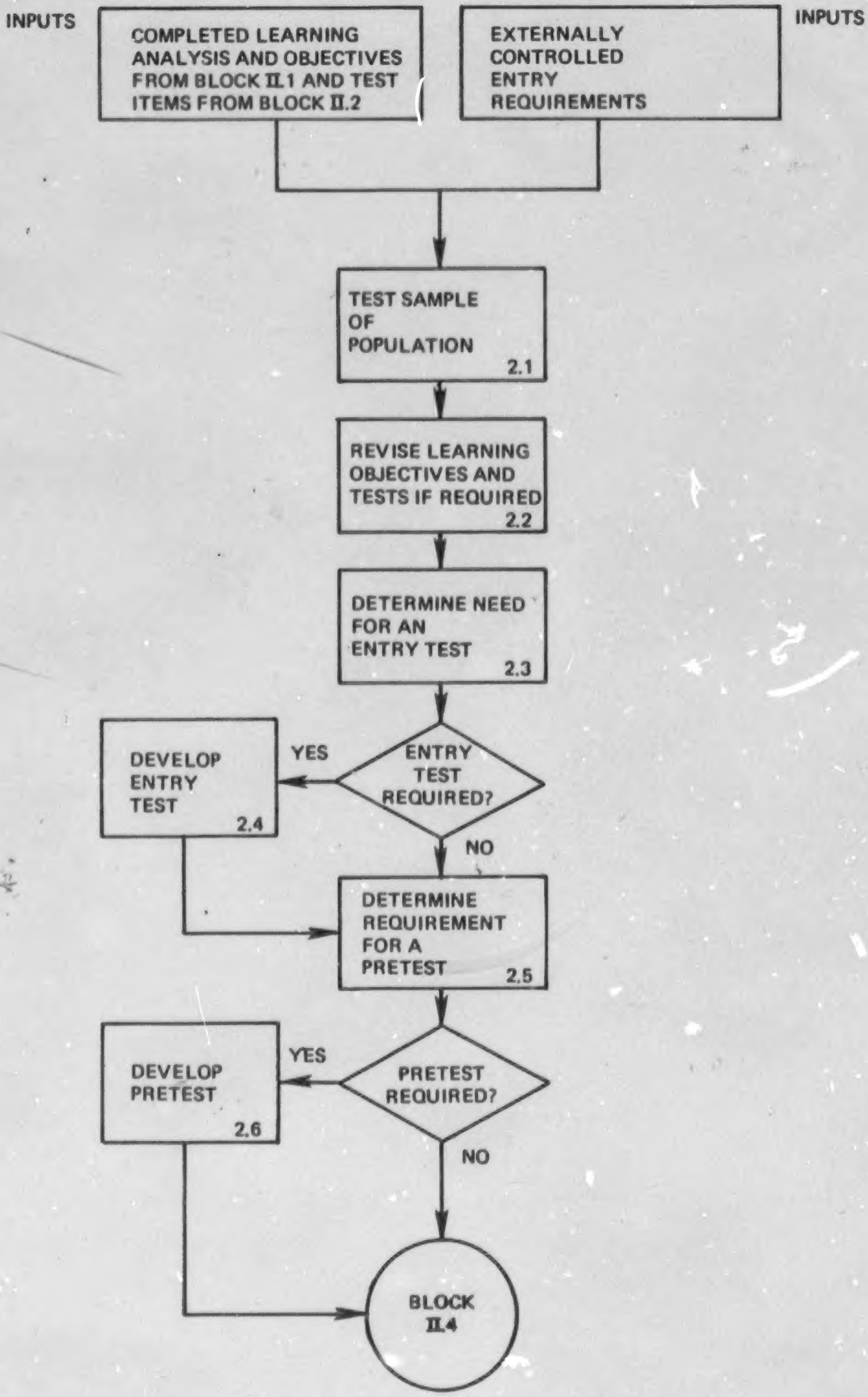
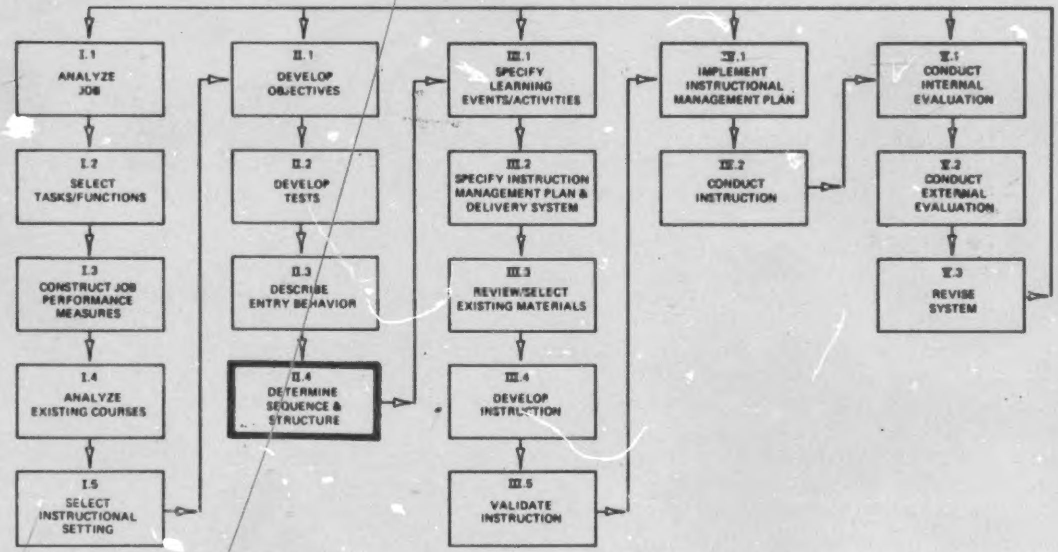

INPUTS
COMPLETED LEARNING ANALYSIS AND OBJECTIVES FROM BLOCK II.1 AND TEST ITEMS FROM BLOCK II.2
EXTERNALLY CONTROLLED ENTRY REQUIREMENTS
INPUTS
TEST SAMPLE OF POPULATION 2.1
REVISE LEARNING OBJECTIVES AND TESTS IF REQUIRED 2.2
DETERMINE NEED FOR AN ENTRY TEST 2.3
ENTRY TEST REQUIRED?
YES
DEVELOP ENTRY TEST 2.4
NO
DETERMINE REQUIREMENT FOR A PRETEST 2.5
PRETEST REQUIRED?
YES
DEVELOP PRETEST 2.6
NO
BLOCK II.4

FIGURE II.6: Flowchart for Block II.3, DESCRIBE ENTRY BEHAVIOR.

BLOCK II.4: DETERMINE SEQUENCE AND STRUCTURE



I.1 ANALYZE JOB
I.2 SELECT TASKS/FUNCTIONS
I.3 CONSTRUCT JOB PERFORMANCE MEASURES
I.4 ANALYZE EXISTING COURSES
I.5 SELECT INSTRUCTIONAL SETTING
II.1 DEVELOP OBJECTIVES
II.2 DEVELOP TESTS
II.3 DESCRIBE ENTRY BEHAVIOR
II.4 DETERMINE SEQUENCE & STRUCTURE
III.1 SPECIFY LEARNING EVENTS/ACTIVITIES
III.2 SPECIFY INSTRUCTION MANAGEMENT PLAN & DELIVERY SYSTEM
III.3 REVIEW/SELECT EXISTING MATERIALS
III.4 DEVELOP INSTRUCTION
III.5 VALIDATE INSTRUCTION
IV.1 IMPLEMENT INSTRUCTIONAL MANAGEMENT PLAN
IV.2 CONDUCT INSTRUCTION
V.1 CONDUCT INTERNAL EVALUATION
V.2 CONDUCT EXTERNAL EVALUATION
V.3 REVISE SYSTEM

OVERVIEW

Proper sequencing of learning objectives will help the learner make the transition from one skill or body of knowledge to another, and assure that supporting skills and knowledge are acquired before dependent performance requirements or subject matters are introduced. Structuring related learning objectives into major groupings further simplifies the handling of broader skill or content areas.

DETERMINE SEQUENCE AND STRUCTURE

I.0 INTRODUCTION

The term "learning objective" is used in this block to refer to terminal learning objectives, learning objectives, and learning steps. In this block, you will arrange learning objectives in the sequence in which instruction will be presented to the student. In addition, you will arrange, or structure, related learning objectives into major groups to simplify further handling of broader content areas.

The purpose of sequencing learning objectives is to help assure that when instructional materials are developed learning each objective is placed in optimum relationship to other learning objectives. Proper sequencing will help produce the most learning in the shortest period of time, will help the learner make the transition from one skill or body of knowledge to another, and will assure that the supporting knowledge and skills are acquired before dependent subject matter is introduced. The best sequence is the one that works best for the student. While it obviously would be impossible to evaluate every possible sequence, there are alternatives to consider.

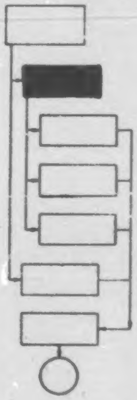
In Block I.2, tasks were selected for training. In Block II.1, terminal learning objectives were derived for each of these tasks. When the information and skills required to master each terminal learning objective were considered, a number of learning objectives and learning steps generally were added. This was necessary since the terminal learning objective was too complex for a first step in the learning process for most of your students. The terminal learning objectives were broken down into less complex learning objectives until the assumed entry level of the students was reached.

Next, in Block II.3, these original assumptions about the entry behaviors of students were tested. If the assumptions were wrong, procedures outlined in Block II.1 were used to add or delete learning objectives until the lowest level of learning objective matched the entry behaviors of the students. This revised group of learning objectives is what you need to begin work in this block. If each learning objective, along with its conditions, standards, and test items where applicable, is listed on a separate form such as the Learning Objective Analysis Worksheet shown in Block II.1, the actual sorting, sequencing, and grouping will be simplified.

The steps in determining sequence and structure are shown in Figure II.9, the fold-out page at the end of this block.

2.0 PROCEDURES

2.1 Determine Relationships Between Learning Objectives



In order to sequence two learning objectives, you first must determine the relationship between them. Two learning objectives may have:

1. a dependent relationship, in that mastery of one requires prior mastery of the other;

2. an independent relationship, in that they are totally unrelated and independent of each other; or
3. a supportive relationship, in that some transfer of learning takes place from one learning objective to the other.

Table II.7 contrasts these relationships, gives examples of each, and shows how the relationship affects sequencing.

The table might give the impression that all pairs of learning objectives that do not have a dependent relationship have either a completely independent or completely supportive relationship. But, most pairs of learning objectives that do not have a dependent relationship probably fall somewhere between these two extreme positions. Between most pairs of learning objectives, some transfer of learning may take place. This makes for some difficulty in sequencing these learning objectives. If you are convinced that very little or no transfer of learning is likely to take place between two learning objectives, consider the relationship an independent one. When in doubt, consider the relationship a supportive one. Guidelines for sequencing learning objectives with independent and supportive relationships will be presented later in this block.

2.2 Sequence Learning Objectives with Dependent Relationships

Sequencing learning objectives with dependent relationships usually is a simple step, particularly when the learning objectives were arranged in the proper hierarchy in Block II.1.

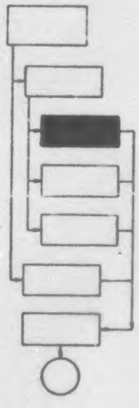


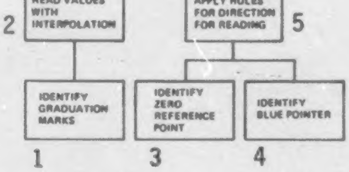
TABLE II.7 Types of Relationships Between Learning Objectives

DEPENDENT	INDEPENDENT	SUPPORTIVE
Skills and knowledges in one learning objective are closely related to those in the other learning objective.	Skills and knowledges in one learning objective are unrelated to those in the other learning objective.	Skills and knowledges in one learning objective have some relationship to those in the other learning objective.
To master one of the learning objectives, it is first necessary to master the other.	Mastering one of the learning objectives does not simplify mastering the other.	The learning involved in mastery of one learning objective transfers to the other, making learning involved in the mastery of the other easier.
EXAMPLES: In math, in order to learn multiplication one must first learn addition. One cannot send messages in Morse Code without first having mastered the codes for each of the letters and numbers. The "sending" skills are totally dependent on the prior learning.	Examples: For a yeoman, "type letters from drafts" is independent of "maintain files." For a wheeled vehicle mechanic, "adjust carburetor" is independent of "torque engine head studs." In both examples, knowing how to do one would not help much with the other.	Examples: "Assemble weapon" has a supportive relationship to "disassemble weapon." "Drive a ¼ ton truck" has a supportive relationship to "drive a 2½ ton vehicle." In both examples, learning to do one would help considerably in learning to do the other.
The learning objectives must be arranged in the sequence indicated by the above hierarchy.	In general, the learning objectives can be arranged in any sequence without loss of learning.	The learning objectives should be placed close together in the sequence to permit optimum transfer of learning from one learning objective to the other.

For example, a terminal learning objective with its supporting learning objectives and learning steps might look like Figure II.10. You will note that for convenience, only the action components of the objective are listed. Before you can master the terminal learning objective of "get from point A to point B," you must be able to do two learning objectives: "orient map and compass," and "hike with a pack." Some of the learning objectives under "orient map and compass" have dependent relationships. These hierarchally-ordered learning objectives are, therefore, easy to sequence. One sequence is:

1. Identify symbols
2. a. Match symbols to actual terrain
   b. Match symbols to legend
3. a. Use legend
   b. Use grid system
4. Interpret map

Some of the learning objectives present more of a sequencing problem, however. For example, in Figure II.10, which should be placed first, "read compass values from scale" or "align points with scale?" These can be placed in either order, so long as they are both placed before "read compass," and as long as "read compass from scale" comes after the five learning objectives under it.


READ COMPASS
7
READ COMPASS VALUES FROM SCALE
6
ALIGN POINTS WITH SCALE
?
READ VALUES WITH INTERPOLATION
2
APPLY RULES FOR DIRECTION FOR READING
5
IDENTIFY GRADUATION MARKS
1
IDENTIFY ZERO REFERENCE POINT
3
IDENTIFY BLUE POINTER
4

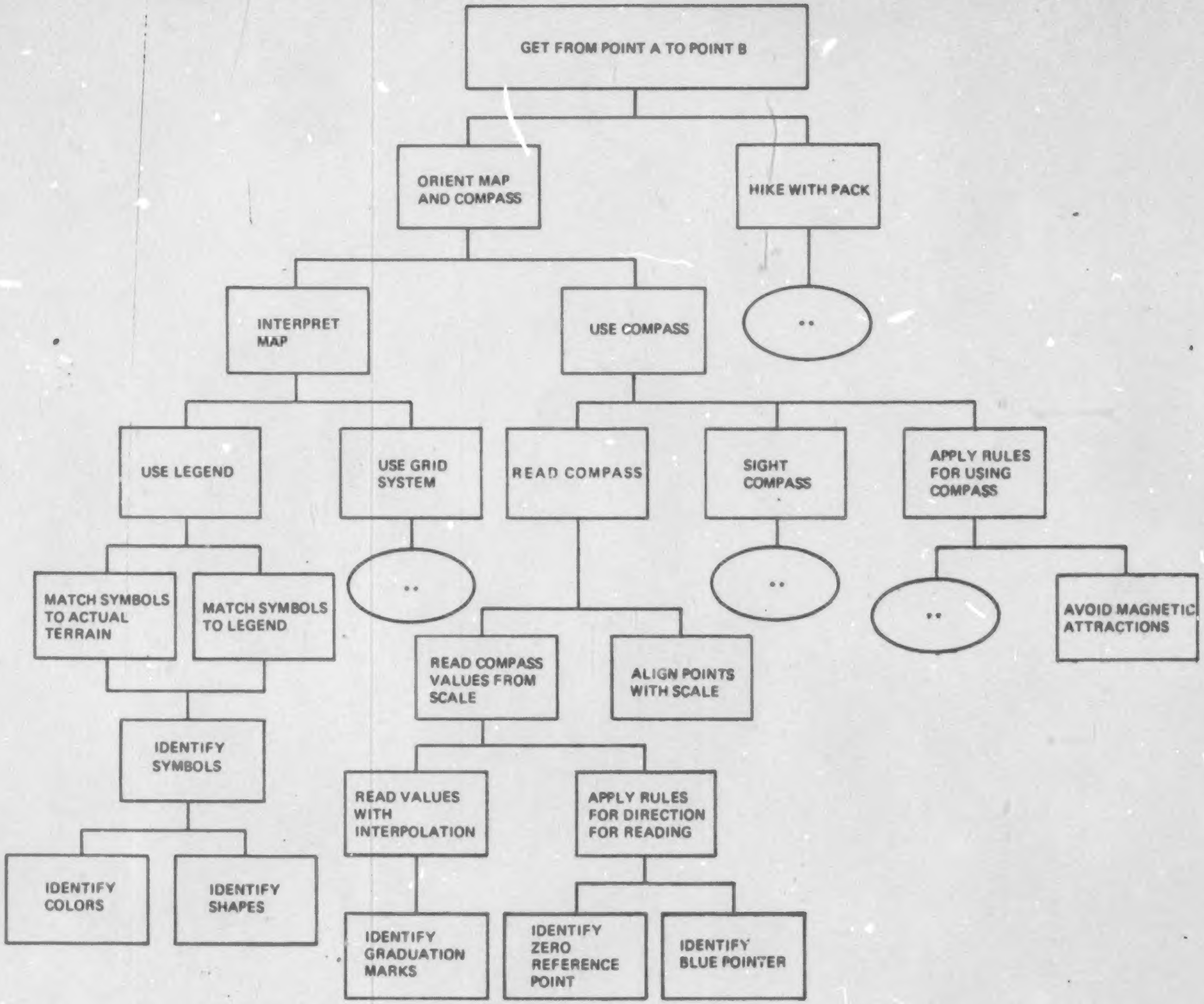
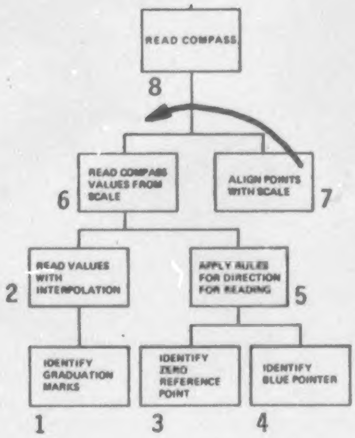
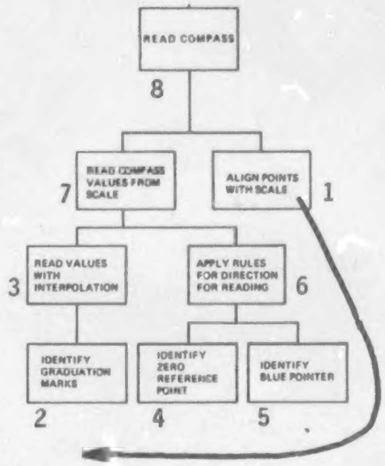

GET FROM POINT A TO POINT B
ORIENT MAP AND COMPASS
HIKE WITH PACK
..
INTERPRET MAP
USE COMPASS
USE LEGEND
USE GRID SYSTEM
READ COMPASS
SIGHT COMPASS
APPLY RULES FOR USING COMPASS
MATCH SYMBOLS TO ACTUAL TERRAIN
MATCH SYMBOLS TO LEGEND
..
..
..
AVOID MAGNETIC ATTRACTIONS
READ COMPASS VALUES FROM SCALE
ALIGN POINTS WITH SCALE
IDENTIFY SYMBOLS
READ VALUES WITH INTERPOLATION
APPLY RULES FOR DIRECTION FOR READING
IDENTIFY COLORS
IDENTIFY SHAPES
IDENTIFY GRADUATION MARKS
IDENTIFY ZERO REFERENCE POINT
IDENTIFY BLUE POINTER

FIGURE II .10: Learning Analysis

However, if you place "align points with scale" within learning objective 1 through 6, you would interfere with the dependent sequence of those learning objectives. Therefore, unless you had a good reason for doing otherwise, you would place "align points" either after "read compass values from scale" or before the group of learning objectives that have a dependent relationship to "read compass values from scale."


READ COMPASS
8
READ COMPASS VALUES FROM SCALE
6
ALIGN POINTS WITH SCALE
7
READ VALUES WITH INTERPOLATION
2
APPLY RULES FOR DIRECTION FOR READING
5
IDENTIFY GRADUATION MARKS
1
IDENTIFY ZERO REFERENCE POINT
3
IDENTIFY BLUE POINTER
4

OR


READ COMPASS
8
READ COMPASS VALUES FROM SCALE
7
ALIGN POINTS WITH SCALE
1
READ VALUES WITH INTERPOLATION
3
APPLY RULES FOR DIRECTION FOR READING
6
IDENTIFY GRADUATION MARKS
2
IDENTIFY ZERO REFERENCE POINT
4
IDENTIFY BLUE POINTER
5

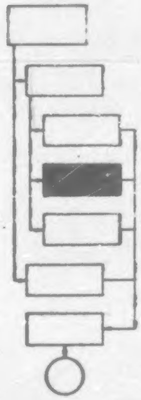
There are other independent relationships in Figure II.10. For example, "sight compass" has a dependent relationship with "use compass." But, since it has an independent relationship with the other learning objectives, "sight compass" can be placed anywhere in the sequence so long as it precedes "orient map and compass." Again, as with "align points with scale," unless you had a good reason for doing otherwise, you would avoid placing "sight compass" within a group of learning objectives that have dependent relationships with each other.

While the above are examples of learning objectives with dependent relationships that support a terminal learning objective, the same rules apply to sequencing terminal learning objectives. For example, one terminal learning objective might be to operate a certain piece of equipment, while another terminal learning objective might be to instruct others in the proper operation of the equipment. Most likely a dependent relationship exists between these two terminal learning objectives; therefore, you would place "operate equipment" before "instruct others."

Generally, when you place a particular terminal learning objective in a certain position in the sequence, you will locate the learning objectives that support the terminal learning objective with it. This is because of the dependent relationship of the learning objective to the terminal learning objective, and because of the transfer of learning that is more likely to occur when closely related learning objectives are kept together. Some exceptions to this rule will be pointed out later in Section 2.5 of this block.

2.3 Sequence Learning Objectives with Supportive Relationships

The one basic rule for sequencing learning objectives with supportive relationships was just stated in the previous section. It is to place the learning objective as close together in the sequence as practical so that optimum transfer of learning can take place.



In addition to this basic rule, there are several other good reasons for placing learning objectives close together in the sequence. You may wish to place learning objectives close together if the conditions under which the learning objectives are carried out are identical or similar, and if the conditions are difficult or expensive to produce at random times. For example, if several learning objectives have conditions such as "at night," "on muddy terrain," or "when flying at an altitude of 20,000 feet," you will probably wish to place the "at night" learning objectives together, the "on muddy terrain" learning objectives together, etc.

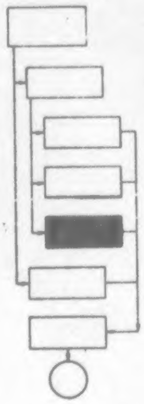
Also, if a particular piece of equipment must be available in order to accomplish a group of learning objectives, and if you are not likely to have continuous access to that equipment, you will probably wish to group the learning objectives that use that particular equipment. In addition, you will want to keep the order of the group of learning objectives within the total program as flexible as possible. For example, if the learning objective is "perform maintenance on helicopter," you will have to wait until the helicopter is available for maintenance before you can accomplish the objective.

A remaining question is: Which of two supportive learning objectives should be placed first in the sequence? At present, there are no hard and fast rules for sequencing objectives that have supportive relationships. Since there are no rules, do not specify sequence at this point. The instructors and materials developers can select the sequence in Block III.4, where logic-based rather than data-based sequencing patterns like simple to complex, chronological order, etc. are presented.

While the effectiveness of various sequencing techniques is still under question, a number of conclusions have been reached about sequencing in general.

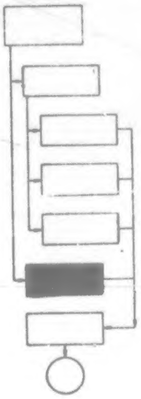
1. Sequencing effects are long-range. The advantages or disadvantages of using any sequencing scheme will not likely show up immediately. Therefore, end-of-course tests should be used for evaluating effectiveness of sequencing techniques. Within-course tests of small portions of the course are not likely to reveal the true effects of sequence.
2. Sequence is important to low-aptitude students. Students who have a high aptitude for the subject matter will learn it in spite of sequencing. The lower aptitude of the learner for the content, the more important it becomes that some type of sequence and structure is provided.
3. Sequence is important with unfamiliar materials. Students who are familiar with materials will learn regardless of order of presentation. But as material becomes increasingly Unfamiliar to the student, the importance of sequence increases.
4. Sequence is important to non-redundant materials. Some instructional materials are especially redundant, stating important points over and over again. Sequencing is not especially important with these materials, because the student can pick up the second time anything he has missed the first time. But if materials are non-redundant and state their points only once, it is important that the materials be sequenced according to some rationale.

2.4 Sequence Learning Objectives with Independent Relationships



As was mentioned earlier, learning objectives with independent relationships may be arranged in any sequence; however, such learning objectives generally will not be placed between learning objectives that have a dependent relationship to each other. Any of the guidelines listed for sequencing learning with a supportive relationship may also be used for sequencing objectives with independent relationships. However, with the latter, you need not be concerned about locating the learning objectives close together in the sequence unless condition or equipment constraints indicate otherwise.

2.5 Sequence Common-Factor Learning Objectives



Common-factor learning objectives are learning objectives that are identical or learning objectives that have identical action words and similar objects of the action in the learning objective statement. Figure II.11 contains an example of the former and Figure II.12 contains an example of the latter.

Consider the learning objective "desolder." It occurs under both "remove defective capacitor" and "remove transformer." But you will want to teach desoldering only one time. Therefore, you have two choices. You can delete the learning objective in all cases except the first time

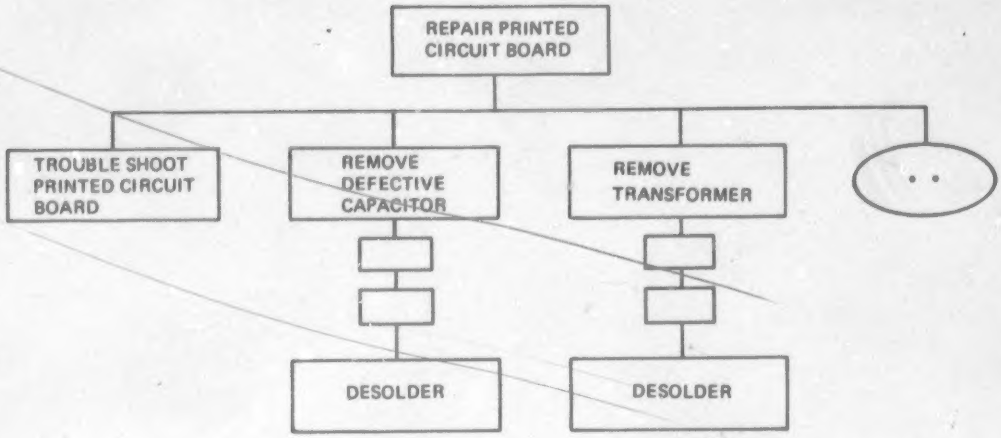

REPAIR PRINTED CIRCUIT BOARD
TROUBLE SHOOT PRINTED CIRCUIT BOARD
REMOVE DEFECTIVE CAPACITOR
REMOVE TRANSFORMER
• •
DESOLDER
DESOLDER

FIGURE II.11: Example of Partial Learning Analysis Showing Common Element Learning Objectives

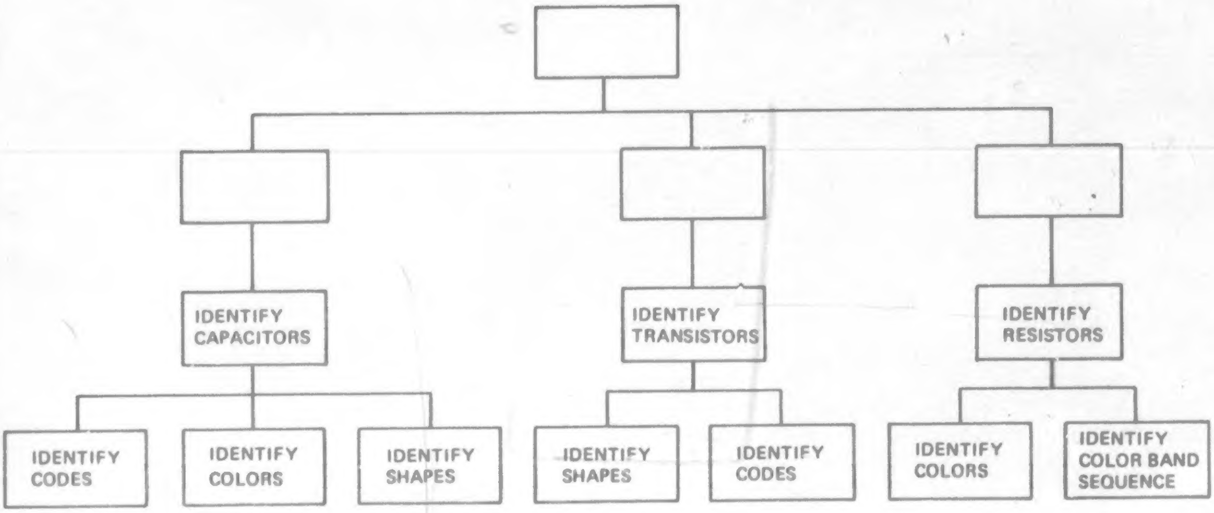

IDENTIFY CAPACITORS
IDENTIFY TRANSISTORS
IDENTIFY RESISTORS
IDENTIFY CODES
IDENTIFY COLORS
IDENTIFY SHAPES
IDENTIFY SHAPES
IDENTIFY CODES
IDENTIFY COLORS
IDENTIFY COLOR BAND SEQUENCE

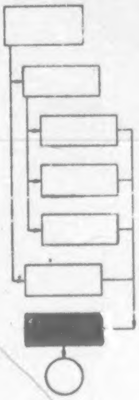
FIGURE II.12: Example of Partial Learning Analysis Showing Similar Learning Objectives

it appears in your list of sequenced objectives. Or, since desoldering is a prerequisite to a number of other objectives, you can delete it from every place it appears and teach it (probably along with soldering, if soldering is required in the course),near the beginning of the course.

In Figure II.12, note that "identify capacitors," "identify transistors," and "identify resistors" are required at different points. One logical way to handle these common factor learning objectives is to group all "identify" learning objectives and place them near the beginning of the course.

While common-element learning objectives generally should be listed early in the sequence because they represent information or skills basic to many learning objectives, the delay between introducing such objectives and the actual application of the objectives should be minimized. This is so that material learned at the beginning of training will not be forgotten by the time it is practiced as a part of other learning objectives.

2.6 Structure Learning Objectives into Groups



While sequencing learning objectives, you undoubtedly realized that you were dealing with quite a few items; so many, in fact, that you might have had difficulty in getting a clear picture of the relationship between all of them. You can partially overcome this difficulty by dividing the learning objectives into large groups that will provide organized, manageable blocks of content with which you can work. How many learning objectives you group into a block is an arbitrary matter. At this point, you are simply identifying learning objectives that can be grouped because of the close relationship between the learning objectives involved. Grouping can help you in the following ways:

A. Grouping content areas early will help you get a clearer picture of the scope and nature of your developing program.

B. Grouped learning objectives can be worked on independently. If one person is responsible for development of the total system, he can work on later groups if all the material is not available for earlier groups.

C. When more than one person is assigned to develop course materials, different people can be assigned responsibility for different groups. Each person then can work relatively independently on a group of learning objectives, conferring with others as needed.

Following are some guidelines that should be helpful in dividing the learning objectives into groups:

A. Remember that some grouping of tasks was done in Block I.5. While this was a tentative grouping, the learning objectives for these groups of tasks should be kept together unless a decision has been made to change the grouping.

B. For a particular group, select learning objectives that bear a close relationship to each other. Combined, they should make a self-contained group.

C. Combine learning objectives so that the group has a natural beginning and ending point.

D. Be sure all learning objectives are included somewhere.

E. In general, learning objectives within your groups will remain in exactly the same order as your original sequence. However, since dividing learning objectives into groups should help clarify your total program, do not hesitate to re-sequence objectives where necessary.

F. Do not assume that your group of learning objectives is unalterable. Subsequent decisions may require you to re-evaluate what should constitute a group.

3.0 OUTPUTS

The outputs of this block should consist of:

3.1 Products

The final list of sequenced and structured learning objectives. (See examples that follow.)

3.2 Other Documentation

1. Rationale for any major sequencing decisions
2. Rationale for any major changes made in the sequence as a result of Phase III, IV, and V activities

EXAMPLES

Structured learning objectives for the Job: OH-58 Helicopter Repairman (Action portion only)

1. Main Transmission Functions
    A. Main transmission pylon supports
        1. inspect main transmission pylon supports
        2. install main transmission pylon supports
        3. remove main transmission pylon supports

B. Main Transmission drag pin assembly
   1. procure main transmission drag pin assembly
   2. inspect main transmission drag pin assembly
   3. install main transmission drag pin assembly
   4. remove main transmission drag pin assembly

C. Main Transmission Drive Quill Seals
   1. inspect main transmission drive quill seals

D. Main Transmission Thermo Switch
   1. procure main transmission thermo switch
   2. inspect main transmission thermo switch
   3. install main transmission thermo switch
   4. remove main transmission thermo switch

E. Main Transmission Oil Filter Head Assembly
   1. inspect main transmission oil filter head assembly
   2. install main transmission oil filter head assembly
   3. remove main transmission oil filter head assembly

Sequenced learning objectives for the task: Maintain power train system on OH-58 helicopter. (After the task analysis in Block II.1, Figure II.3.)

Point to and Name:

1. each component of an actual OH-58 helicopter drive shaft while referring to an exploded view diagram of the drive shaft.

2. Disassemble the OH-58 helicopter drive shaft while referring to a checklist which names but does not picture the components.

3. Dissassemble the drive shaft without the aid of a checklist or drawing.

4. Assemble a drive shaft while referring to a checklist which names but does not picture the components.

5. Assemble the drive shaft without the aid of a checklist or drawing.

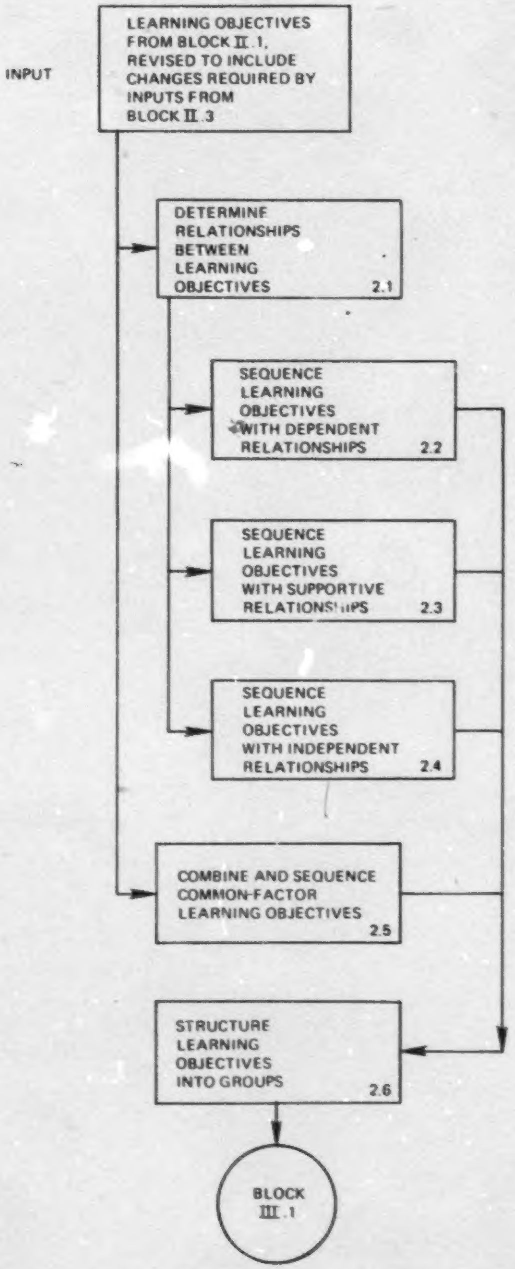

INPUT
LEARNING OBJECTIVES FROM BLOCK II.1, REVISED TO INCLUDE CHANGES REQUIRED BY INPUTS FROM BLOCK II.3
DETERMINE RELATIONSHIPS BETWEEN LEARNING OBJECTIVES 2.1
SEQUENCE LEARNING OBJECTIVES WITH DEPENDENT RELATIONSHIPS 2.2
SEQUENCE LEARNING OBJECTIVES WITH SUPPORTIVE RELATIONSHIPS 2.3
SEQUENCE LEARNING OBJECTIVES WITH INDEPENDENT RELATIONSHIPS 2.4
COMBINE AND SEQUENCE COMMON-FACTOR LEARNING OBJECTIVES 2.5
STRUCTURE LEARNING OBJECTIVES INTO GROUPS 2.6
BLOCK III.1

FIGURE II.9: Flowchart of Block II.4. DETERMINE SEQUENCE AND STRUCTURE

REFERENCES

REFERENCES

PHASE II

Block II.1

Gagné, R. M. The conditions of learning (2nd ed.). New York: Holt, Rinehart and Winston, Inc., 1970.

Defining objectives for learning is one of the critical events of instruction. The components of a properly defined behavioral objective are discussed in reference to their relevance to the design of instruction.

Gagné, R. M. Essentials of learning for instruction. Hinsdale, Ill.: The Dryden Press, 1974.

This is a brief text highlighting the essential facts of human learning and emphasizing the role of the instructor in the classroom. It describes the development of learning objectives and provides examples of learning objectives for all categories of learning outcomes.

Gagné, R. M., & Briggs, L. J. Principals of instructional design. New York: Holt, Rinehart and Winston, Inc., 1974.

The development of behavioral objectives for different types of learning is explained. The preparation of objectives which describe the situation, human capability, object, action and constraints is presented for analysis.

Kibler, R. J., Cegala, D. J., Barker, L. L., & Miles, D. T. Objectives for instruction and evaluation. Boston: Allyn and Bacon, 1974.

A detailed analysis of the elements in objectives necessary for the planning and design of instruction is a vital prerequisite for the production of effective instruction. This book presents the important functions that objectives can serve in improving instruction.

Mager, R. F. Preparing instructional objectives. Belmont, Calif.: Fearon, 1962.

This short book defines educational objectives--behavior, conditions, and criterion of performance. Although this book is aimed at teachers, the recognition of the need to specify objectives in terms of expected student performance has wide-spread importance in any educational program.

Marine Corps Development and Education Command. Analysis of performance requirements (IAC 0202). Quantico, Va.: Instructor Training School, Educational Center, n.d.

"Analysis of Performance Requirements" provides a brief but systematic description of job analysis procedures. The booklet outlines procedures for subdividing Defense Occupational Specialties into separate observable behaviors, which in turn form the basis for learning objectives.

Swezey, R. W., & Pearlstein, R. B. *Developing criterion-referenced tests*. Reston, Va.: Applied Science Associates, 1974.

The development of criterion-referenced tests requires a statement of objectives. If valid tests are to be produced, then the objectives should be evaluated to assess their adequacy. Levels of objectives are identified as well as standards for evaluating them.

REFERENCES

PHASE II

Block II.2

Bloom, B. L. Learning for mastery. *Evaluation Comment*, 1968, I, No. 2.

An approach to learning receiving increased interest is the "learning for mastery" concept based on the assumption that over 90 percent of all students are able to learn any task given the proper conditions and with the employment of optimum individual teaching strategies.

Department of the Air Force. *Handbook for designers of instructional systems: Objectives and tests* (Vol. III, 50-58). Washington, D.C.: Headquarters, United States Air Force, Air Training Command, July 1973.

Three types of criterion-referenced tests are reviewed: (1) the course criterion test; (2) the diagnostic test; and (3) the survey test. The process of translating objectives into test items is reviewed and specific directions are given on how to develop valid tests.

Department of the Army. *Guidelines for the conduct of performance-oriented training* (TRADOC Pamphlet No. 600-11). Fort Monroe, Va.: Headquarters, United States Army Training and Doctrine Command, October 1973.

This manual provides guidelines for achieving this objective to those people responsible for conducting and monitoring training in basic and MOS-related skills.

Deterline, W. A., & Lenn, P. D. *Coordinated instructional systems training: A self-study course for teachers*. Palo Alto, Calif.: Sound Education, Inc., 1972.

The design of valid tests is one critical component of the instructional design process. In order to assess the effectiveness of any instructional program it is necessary to develop some means of measuring the output of student learning.

Johnson, E., & Mirabella, A. Test fidelity: Congruence of test conditions with actual Army tasks. *Proceedings of the 16th Annual Conference of the Military Testing Association*, 1974, 590-595.

One method to reduce the cost of training and testing procedures is to develop simulated approaches to testing for appropriate job tasks. Fidelity as it relates to training and testing is discussed in regard to specific job tasks.

Osborn, W. C., Harris, J. H., & Ford, J. P. Functionally integrated performance testing. *Proceedings of the 16th Annual Conference of the Military Testing Association*, 1974, 582-589.

Job proficiency tests play a critical role in decisions relating to evaluation training, evaluating MOS proficiency,or evaluating unit readiness. This paper presents the results of research investigating various methods of job proficiency evaluation.

Sugrue, E. D. (Project Director). Turning point...an evaluation of the professional skills needed to support the continued growth of the volunteer Army. Boston: Harbridge House Inc., 1974.

This report analyzes a study designed to identify the major training needs of Army recruiters, to design a master plan for meeting these needs, and to develop a curriculum design for a basic recruiting training course. Detailed descriptions of the test methodology used, as well as the type of questionnaires employed to gather data are described.

Swezey, R. W., & Pearlstein, R. B. Developing criterion-referenced tests. Reston, Va.: Applied Science Associates, 1974.

Criterion-referenced tests measure what an individual can do or knows compared to what he must be able to do or know in order to successfully perform a task. This manual provides guidance on the construction and use of criterion-referanced tests.

Thorndike, E. L. (Ed.). Educational measurement. Washington: American Council on Education, 1971.

This text is a collection of papers dealing with issues in the construction, design and administration of tests. A background discussion of measurement theory relevant to a clear understanding of testing is elaborated upon in several articles.

REFERENCES

PHASE II

Block II.3

Thorndike, E. L., (Ed.). *Educational measurement*. Washington, D.C.: American Council of Education, 1971.

Thorndike's book is a collection of articles concerned with traditional measurement questions. Several articles deal with test construction and design, measurement theory, and analyzing data from test items. The naive test designer would find these articles helpful.

REFERENCES

PHASE II

Block II.4

Department of the Air Force. *Handbook for designers of instructional systems: Planning, developing, and validating instruction* (Vol.IV, AFP 50-58). Washington, D.C.: Headquarters, United States Air Force, July 1973.

Once the objectives for a course of study have been defined, it is necessary to sequence objectives so that transition from one skill to another will be optimal. Objectives are sequenced and structured to provide a smooth flow of learning opportunities.

Gagné, R. M., & Briggs, L. J. *Principals of instructional design*. New York: Holt, Rinehart and Winston, Inc., 1974

Course planning involves the sequencing of instruction to ensure that relevant prerequisite or subordinate capabilities are learned before superordinate tasks. One method of sequencing instruction is to design learning hierarchies which trace prerequisite capabilities of an objective to the entry behavior level of the trainee.

GLOSSARY

ACRONYMS

AFS - Air Force Speciality

AR - Army Regulations

CMI - Computer Managed Instruction

CRT - Criterion Referenced Test

CODAP - Comprehensive Occupational Data Analysis Programs

DOS - Defense Occupational Specialities

FM - Field Manuals

FOJT - Formal On The Job Training

GED - General Educational Development

HQ - Headquarters

ISD - Instructional Systems Development

ISS - Installation Support School

ITV - Instructional Television

JPA - Job Performance Aids

JPM - Job Performance Measure

KOR - Knowledge of Results

LO - Learning Objective

LS - Learning Step

MODB - Military Occupational Data Bank

MOS - Military Occupational Specialities (Army/Marine Corps)

MWO - Modification Work Orders

NIH - Not Invented Here

NOTAP - Naval Occupational Task Analysis Program

OJT - On The Job Training

OSR - Occupational Survey Report

POI - Program of Instruction

QQPRI - Qualitative and Quantitative Personnel Requirements Identification

RS - Resident School

SME - Subject Matter Expert

SMP - System Master Plan

SOP - Standing Operation Procedures, Standard Operating Procedures

STEP - Self-Teaching Exportable Package

TAK - Trainer Appraisal Kit

TI - Traditional Instruction

GLOSSARY

ABILITY GROUPING: Arrangement whereby students are assigned to groups on the basis of aptitude testing.

ABSOLUTE STANDARDS: A statement defining the exact level of performance required of a student as a demonstration that he has mastered the course objective(s). Criterion-referenced tests are usually based on an absolute standard.

ACHIEVEMENT GROUPING: Arrangement whereby students are assigned to groups according to their performance on pretests of units of the course.

ACTION: Occurs in terminal learning objectives and learning objectives; describes the specific behavior the learner is to exhibit after training.

ACTION VERBS: Verbs that convey action and reflect the type of learning that is to occur. Action verbs must reflect behaviors that are measureable, observable, verifiable, and reliable.

ACTIVITY STEP: One simple operation or movement that comprises part of a job. A job performance standard consists of a list of these operations or movements.

ADJUNCT PROGRAMMING: A method of combining the features of good existing instructional materials (e.g., films, textbooks) with special directions or questions to guide the learner.

ADMINISTRATIVE CRITERIA: In media selection, the options that courseware be developed locally or at some central location.

ALGORITHM: A rule or procedure for accomplishing a task or solving a problem.

ALPHANUMERIC: Refers to a combination of letters and numbers; for example, on the keyboard of a teletype.

ALTERNATE PATH: Refers to elements which have relationships in which the specific situation encountered determines the appropriate sequence, or it may be another way of meeting the same objective.

TLO - Terminal Learning Objective

TM - Technical Manuals

TOE - Tables of Organization and Equipment

TRADOC - U.S. Training and Doctrine Command

BLOCKING: Refers to the process of defining and illustrating the different camera movements and camera shots in a television or film script. A blocked script may also contain directions as to the movement of actors as well as scenery changes.

CHECKLIST: Job performance aid which lists the elements of a task in the sequence of execution. The job holder places a check beside each element as it is accomplished, thus insuring that the task is completed.

CHRONOLOGICAL ORDER: Arranging content in order from one topic to another based on when they occurred in time.

COMMON-FACTOR LEARNING OBJECTIVES: Refers to learning objectives that are identical, or that have identical action words and similar objects of the action in the learning objective statement.

COMPARATIVE SEQUENCE: Sequencing which starts with familiar topics and goes to unfamiliar ones.

COMPLEXITY CRITERION: In media selection, the degree of complexity required of instructional materials in order to adequately train students to meet learning objectives.

COMPUTER MODELS TECHNIQUE: Occurs during the simulation of an operational system; involves having a computer simulate the major operations of the system, under a variety of conditions.

CONDITIONS: Occurs in terminal learning objectives; describes what is presented to the student in order to accomplish the specified action, that is, it describes the important aspects of the performance environment.

CONTIGUITY: Refers, in learning, to the principle that events which occur closely together become associated by the learner.

CONTINGENCY MANAGEMENT: The establishment of a set of procedures by which trainees are required to perform a certain amount of work or to achieve certain objectives before engaging in activities that are preferred by the trainee (e.g., recreation, a break, or a more desirable training event).

ASSESSMENT: A judgment of the effectiveness and efficiency of a training system, in terms of measurement and evaluation.

ASSOCIATION DEVICES: Memory aids, techniques which ease recall. Mnemonic devices.

ATTITUDE: A persisting state of a person that influences his choice of action.

ATTITUDE MEASURE: An instrument designed to gather information about how people feel toward a particular object. This could include liking or disliking subject matter, usefulness of a medium, or opinions about the medium.

AUDIO-ONLY PROGRAM: A production which does not contain any video or pictures; for example, a record or radio program.

AUDIO PRODUCER: Prepares tape recordings and produces audio programs. The audio producer combines narration, music, and other sound effects in the production of an audio program.

AUDIOVISUAL MEDIA: Refers to any device such as television or film which is both seen and heard.

BASELINE DATA: Valid and reliable information about the current level of performance of the intended student population. This data can be used to confirm the need to develop new instruction, or can be used as a comparison in ascertaining differences between students' performance before and after instruction.

BEHAVIORAL ATTRIBUTES: Qualities or activities that characterize an object or process. Behavioral attributes characterize each category of learning.

BLOCK SCHEDULING: Mode of instruction whereby all students receive the same instruction at the same time.

DECISION TREE: Flowchart; graphic representation of the sequence of a specific activity or operation.

DELIVERY SYSTEM: Any method containing plans and procedures for the presentation of instruction. Platform instruction, television, FOJT, and STEPs are all delivery systems.

DEPENDENT RELATIONSHIP: Occurs when skills and knowledges in one learning objective are closely related to those in the other learning objective. In order to master one of the learning objectives, it is first necessary to learn the other.

DOWNTIME: Refers to the period of time when equipment is inoperable.

DUTY: One of the major subdivisions of work performed by one individual. One or more duties constitute a job.

DUTY TITLE: Categorizes groups of tasks under identifiable headings to help in the organizing of lists of tasks.

EMPIRICALLY BASED REVISION: Revision based on the results of test data and the collection of other types of quantitative information.

ENTRY BEHAVIOR: The skill, knowledge, and/or attitude required before beginning a new segment of instruction; also may refer to the capability a person has prior to new learning.

ENTRY SKILLS: Specific, measurable behaviors that have been determined through the process of analysis of learning requirements to be basic to subsequent knowledge or skill in the course.

ENTRY SKILLS TEST: A measurement instrument designed to determine if a student already possesses certain skills or knowledge needed as a prerequisite before undertaking new instruction.

ENTRY TEST: Contains items based on the objectives that the intended students must have mastered in order to begin the course.

COURSE DOCUMENTATION: Information describing the current content of a course (instructional materials, tests, instructor's manual, evaluation plan, student's manual) and its developmental history (job analysis, criteria for selecting tasks for training, previous revisions).

CLUSTERING: A process of organizing many tasks into groups for the purpose of deciding upon the optimal instructional setting mix for that group of tasks.

CRITERION-REFERENCED TEST: Measures what an individual can do or knows, compared to what he must be able to do or must know in order to successfully perform a task. Here an individual's performance is compared to external criteria or performance standards which are derived from an analysis of what is required to do a particular task.

CRITICAL CUE: Cue which must be correctly interpreted by the student before we can correctly perform the associated task.

CRITICAL SEQUENCE: Sequencing of topics or objectives according to their importance.

CUE: A word or other signal that initiates or guides behavior; a prompt.

CUT-OFF SCORE: Minimum passing score.

DATA: Collection of facts or numerical values resulting from observations of situations, objects, or people.

DATA COLLECTION PLAN: An outline of the procedures and techniques that will be used to gather information for any specific purpose.

DATA RECORDING PLAN: Method of tabulating background responses and test data.

DECAY RATE: The amount of time it takes a trainee to forget what he has learned in school. If the decay rate is high then a trainee should not receive instruction in a specific task until shortly before he will actually perform it.

FOJT--FORMAL ON-THE-JOB TRAINING: This type of training takes place in the actual work situation.

FOLLOW-UP ACTIVITIES: The work events that occur after a course of instruction has been completed.

FORMATIVE EVALUATION: The iterative process of developing and improving instructional materials and procedures.

FIDELITY: Refers to how well the actions, conditions, cues, and standards of the JPM approximate those of the task.

FIELD USER NEEDS: The general and specific duties that will have to be taught to the trainee if he is to be able to adequately perform in a real world environment.

FIRST DRAFT MATERIALS: Any materials (book, film, etc.) which are not yet committed to their final form. First draft refers to the fact that the materials are still in 'rough' form and will be revised on the basis of test results and other data.

FLOWCHART: A graphic representation of the sequence of a specific activity or operation; decision tree.

FRONT END ANALYSIS: Refers to job analysis, selection of tasks for training, and development of JPMs.

FIXED SEQUENCE: Refers to elements that are always done in the same order.

GRAPHIC ARTIST: Designs and prepares a wide variety of visual illustrations such as graphs, charts, and diagrams.

GRAPHIC SCALE: Measurement device which includes some type of number line on which students indicate their attitude toward a social object.

GO NO-GO: Pass-fail; criterion of evaluation whereby student cannot be "partially correct". He is either 100% correct (go) or incorrect (no-go).

ERROR OF HALO: Occurs when an observer sometimes allows his rating of performance to be influenced by his general impression of a person.

ERRORS OF LOGIC: Occur when two or more traits are being rated. It is present if an observer tends to give similar ratings to traits which do not necessarily go together. The traits are related only in the mind of the person making the error.

ERRORS OF STANDARD: Occur when observers tend to rate performers too high or too low because of differences in their standards.

EVALUATION: The process of interpreting the results of measurement data (e.g., tests, JPMs) for the purpose of making a judgment or decision on the instruction or on the success of a trainee.

EVALUATION CRITERIA: The measures used to determine the adequacy of performance.

EVALUATION PLAN: A method or outline of what set of procedures will be used to gather data and information for the purpose of assessing a course of instruction.

EXTERNAL CUES: Signals for action that exist outside of the student (conditions, features, or characteristics of the job environment that trigger action).

FALSE NEGATIVE: Occurs when a person can perform the task but receives a failing score on the test.

FALSE POSITIVE: Occurs when a person cannot perform the task but receives a passing score on the test.

FEEDBACK: The return of information. Information on student performance is "fed" back to the student so that he can improve that performance; to the instructional designer so that he can improve materials and procedures on the basis of student needs; to the management system so it can monitor the internal and external integrity of the instruction and make appropriate revisions. Or, refers to the flow of data or information from one step in the ISD Model to others.

INSTRUCTIONAL MANAGEMENT PLAN: The specifications for the scheduling, instruction and evaluation of trainees toward the goal of course completion.

INSTRUCTIONAL PROGRAM: The development of various materials (books, audiovisual productions, etc.) designed to achieve a specific training goal.

INSTRUCTIONAL SETTING: The vehicle through which a trainee who initially is not able to perform a task becomes proficient in performing the task; for example, performance aids, self-teaching exportable packages, formal on-job training, installation support schools, and resident schools.

INSTRUCTIONAL SUPPORT: Learning resources; different kinds of material, number of instructors, amount of time, etc. which will contribute to the learning situation.

INSTRUCTIONAL SYSTEM: The total effort, distinct from the operating system by location, authority, or mission, that is concerned with the preparation of individuals to serve the operating system.

INTERNAL CUES: Internal biological signals that initiate or guide behavior.

INTERNAL EVALUATION: Assessment of the effectiveness of an instructional program in terms of student performance on stated terminal learning objectives.

JOB: The duties and tasks performed by a single worker constitute his job. If identical duties and tasks are performed by several individuals, they all hold the same job. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.

JOB ANALYSIS: The basic method used to obtain a detailed listings of duites, tasks, and elements necessary to perform a clearly defined, specific job, involving observations of workers and conversations with those who know the job, in order to describe in detail the work involved, including conditions and standards.

GROUP MANAGEMENT PLAN: Arrangement whereby instruction is scheduled and conducted for groups instead of individuals.

GROUP TRAINING: A group of people gathered together for the purpose of receiving information or instruction in the performance of some specific task.

HARD DATA: A direct and precise measure of a specific performance. A JPM is an example of hard data while an attitude questionnaire is a less direct measure, providing soft data.

HIGH DENSITY SIGNAL: A signal containing many cues. A low density signal contains few cues.

INDEPENDENT RELATIONSHIP: Occurs when skills and knowledges in one objective are unrelated to those in the other objective. Mastering one of the objectives does not simplify the other.

INDICATOR BEHAVIOR: Refers to that behavior that indicates the presence of a specific attitude.

INDIVIDUALIZED INSTRUCTION: Refers, in the ISD Model, to a management scheme which permits individual characteristics of trainees to be a major determinant of the kind and amount of instruction given. Here, it nearly always implies some form of self-pacing.

INSTALLATION SUPPORT SCHOOLS: Organized and operated by individual units or commands to meet local training requirements.

INSTRUCTIONAL CONDITIONS: The amount of participation which the instruction requires of the learner. Instructional conditions may be active (the learner produces or practices) or passive (the learner sits and listens).

INSTRUCTIONAL DESIGNER: Person who designs and develops a program or course of studies based on a systematic analysis.

INFORMATION: Knowledge; the facts, names, labels, and larger bodies of knowledge that are necessary for successful job performance.

LEARNING GUIDELINES: Statements which specify the learning events and activities appropriate to specific instruction. Learning guidelines combine to form learning subcategories.

LEARNING HIERARCHY: Graphically portrays the relationships among learning tasks in which some tasks must be mastered before others can be learned.

LEARNING OBJECTIVE: Describes precisely what is to be learned in terms of the expected student performance under specified conditions to accepted standards. These learning objectives identify the mental skills, information, attitudes, or physical skills that are required to perform the terminal learning objective.

LEARNING RESOURCE CENTER: Library containing instructional materials and areas for viewing and study.

LEARNING STEP: Occurs when learning objectives are broken down into smaller parts.

LEARNING SUB-CATEGORY: A division of a learning category.

LEARNING TASK ANALYSIS: Procedure used in the domain of intellectual skills to identify prerequisite tasks that must be learned before a person can learn a given task.

LINK TRAINER: Mechanical training device which simulates the cockpit of an aircraft.

RESPONSE BIAS: Tendency to favor a certain response over others.

MANAGEMENT PLAN: Program for the assignment, monitoring, and assessment of the personnel, materials, and resources dedicated to a specific mission, operation, or function.

MASTERY: In terms of learning, refers to meeting all of the specified minimum requirements for a specific performance. Criteria for mastery are defined in the design phase of the ISD Model.

JOB FIDELITY: The degree to which a testing situation truthfully and accurately reflects the job situation.

JOB PERFORMANCE MEASURES: Tests that are used to evaluate proficiency of a job holder on each task he performs.

JOB PERFORMANCE TEST: Test used to determine whether or how well an individual can perform a job. In may include either all of the job performance measures for a particular job or a subset of the job performance measures.

JPA--JOB PERFORMANCE AID: A checklist, instruction sheet, or other device that offers a possible alternative to training rather than an actual method of training; they are developed to eliminate or minimize training requirements for some tasks.

KNOWLEDGE OF RESULTS: Feedback; information provided to the student indicating the correctness of his response. Evaluative knowledge of results indicates what a student is doing right and what he is doing wrong. Comparative knowledge of results indicates how the student's response compares to the objective or standard established by the instructor.

LEARNER CHARACTERICTICS: The traits possessed by learners that could affect their ability to learn (e.g., age, I.Q., reading level, etc.).

LEARNING ACTIVITY: The specific behaviors a student performs during a particular episode of learning.

LEARNING ANALYSIS: A procedure to identify subelements that must be learned before a person can achieve mastery of the performance.

LEARNING CATEGORY: A division of learning behavior. All learning may be classified into one of four learning categories: mental skill, physical skill, information, or attitude.

LEARNING EVENT: The immediate outcome of a learning activity.

MNEMONICS: Methods which make information easier to remember; memory aids.

MODE OF INSTRUCTION: Method of scheduling materials presentation. The instructional mode may be individualized (self-pacing) or group (block scheduling).

MODULE: An individualized self-instructional package usually containing all the necessary materials a learner needs to meet some or part of a terminal learning objective.

MULTIMEDIA PACKAGE: Self-contained instructional unit in more than one medium.

NARRATION: Is the voice overheard on an audiovisual program.

NARRATOR: Is the person whose voice is heard describing or commenting upon the content of a film, television program, etc.

NUMERICAL SCALE: Measurement device which associates verbal descriptions of social objects with numbers and requires students to indicate their attitudes by marking the appropriate number.

OBSERVATION INTERVIEW: Job holder is observed in the job environment performing all or a substantial part of the job; the job holder performs the job while the analyst ask questions.

OFF-LINE: Refers to any activity which does not take place as part of the regular production process.

OVERLEARNING: Refers to the continual practice on a learning task by a person who has correctly performed the task.

PEER TUTORING: A form of instruction in which students at the same or more advanced level of knowledge provide instruction to students at the same or lower level of knowledge on the specific objectives under consideration. Peer tutors are not members of the existing instructional establishment.

MEAN: Arithmetic average calculated by adding up all scores and dividing by the number of scores.

MEASUREMENT: Consists of rules for assigning numbers to objects to represent quantities of attributes.

MEASUREMENT ERRORS: Incorrect procedures carried out during the measurement process which invalidate the results. These errors result from unfounded assumtions made by judges or raters.

MEASUREMENT PROCESS: The operations involved in determining the amount of an attribute (e.g., skill, knowledge, or attitude) possessed by a student.

MEDIA: Means for presenting instructional material to learners; for example, books, audiotapes, and filmstrips.

MEDIA ALTERNATIVE: A form of instructional material that contains the stimulus criteria required by a specific learning activity.

MEDIA MIX: Combination of different media used to present a unit of instruction.

MEDIA POOL: All of the media options suitable for a given unit of instruction. The final media choice is drawn from the media pool.

MEDIA SELECTION: Is the major means of determining how instruction is to be packaged and presented to the student.

MENTAL SET: A preparatory mental adjustment, or readiness, for a particular type of experience.

MENTAL SKILLS: Those processes of identifying, classifying, using rules, and solving problems that involve active mental processing. Mental skills imply the capability of applying the learning to some situation and demonstrating the mental skill, such as thinking, creating, and analyzing.

PROCESS STANDARDS: Refers to the conditions which must be satisfied for a job to be successfully completed. Process standards refer to sequence, accuracy, speed of performance, and completeness.

PROGRAMMED INSTRUCTION: Instructional materials which present subject matter in a series of small sequential units which require responses from the student.

PROMPT: A word or other signal that initiates or guides behavior; a cue.

QUALITY CONTROL: Process of measuring and evaluating in order to maintain course standards through adjustments in instructional materials or procedures.

QUALITY CONTROL DATA: Information which reflects the degree of success achieved by a system or operation.

RANDOM SELECTION: Choosing people or objects at random rather than according to some systematic plan.

RANK ORDER: The assignment of ranks to students. This could refer to groups, such as the top 10%, or simply listing each student from highest to lowest. Rank ordering is appropriate when there is a need to select the fastest, the most accurate, or the best producer.

RATING ERRORS: Errors of standards, ratio, and logic.

RATING SCALE: A measurement device in which a student must choose a response from a range of choices arranged in a continuum from low to high or good to bad, etc.

REGULATIONS: Rules for appropriate conduct and behavior.

RELIABILITY: The consistency with which a test measures the amount of student achievement.

RESIDENT SCHOOLS: These schools are designed to meet service-wide training requirements.

PERFORMANCE EVALUATION: The gathering of data to specifically determine the success of students on a specific task, as a result of a training program.

PERFORMANCE MEASURES: The absolute standard by which a job performance is judged. A performance measure is the inventory of job tasks with each performance objective.

PERSEVERATE: Continue an activity until it is completed, regardless of the difficulty, or the appropriateness of the solution technique to the problem.

PERT--PROGRAM EVALUATION REVIEW TECHNIQUE: PERT is a method of monitoring the flow of a large project by breaking it down into small individual activities and assigning each activity a specified amount of time for completion.

PHYSICAL SKILLS: Specified muscular activities for accomplishing a goal.

POST FEEDBACK DELAY: The pause which follows the presentation of feedback. This allows time for the correct response to "sink in."

POSTTEST: A test administered after the completion of instruction to assess whether a student has mastered the objectives of the course or unit.

PREDICTIVE VALIDITY: The ability of a test score to accurately forecast future performance.

PREDIFFERENTIATION OF STIMULI: Pointing out the distinguishing features of an object and explaining the differences between them.

PRETEST: Administered prior to instruction to determine how much the student already knows.

PROCESS EVALUATION: An early stage in ISD development that identifies which steps in the model will be used for the course under development. The purpose of the process evaluation is to describe and document the actual developmental process for this particular instruction.

SIMULATION: Any change from reality or any imitation of reality. Three types are common: simulating part of the system, simulating the operation of the system, and simulating the environment in which the system will operate.

SIMULATORS: Machines or processes designed to provide training which will have high positive transfer to the real world equipment or situation. Simulators are ordinarily cheaper, safer, or more available than the actual situation or equipment.

SLIDE-TAPE: A combination of visual slides and an audio tape synchronized so that the audio describes the content of the slides.

SOFT DATA: Obtained from attitude or opinion surveys. This data is not as reliable as hard data.

STANDARDS: Occurs in terminal learning objectives or learning objectives; describes the criterion or standard of performance which must be attained.

STIMULUS CRITERIA: Those basic qualities or capabilities of a medium that are required to carry out the intent of the learning activity; for example, visual images, motion, color, and sound.

STORYBOARD: A collection or series of small pictures which describe the action and content that will be contained in an audio-visual or visual-only production. A sequence of these small pictures comprise a storyboard.

SUBJECT MATTER EXPERT: A person who has professional skill in the performance of some job and who is consulted by an instructional designer in the process of job task analysis.

SUPPORTIVE RELATIONSHIP: Occurs when skills and knowledges in one objective have some relationship to those in the other objective; the learning involved in mastery of one learning objective transfers to the other, making learning involved in the mastery of the other easier.

REVISION PLAN: A detailed outline of the procedures to be taken to modify the structure or content of a course.

REWARD SEQUENCE: Scheduling the more pleasant activity to follow the less pleasant activity; can be used to provide a reward for completion.

SAMPLE: A portion or small segment of the students for whom instruction is designed.

SAMPLING PLAN: Procedure for selecting a small but representative group from a larger population.

SCALE: In media selection, some materials must represent actual objects and accurately represent the dimensions of those objects. A model may, for example, be full scale, half scale, or on a 1 to 10 scale with the actual object.

SELF PACING: Mode of instruction whereby each student works through the instructional materials at his own rate of speed.

SELF-PACED MANAGEMENT PLAN: Arrangement whereby instruction is scheduled and conducted for individual students rather than groups of students.

SELF-TEACHING EXPORTABLE PACKAGES: Self instructional study units; generally sent to the student wherever he is stationed.

SEQUENCING: Ordering instruction; proper sequencing allows the learner to make the transition from one skill or body of knowledge to another, and assures that supporting skills and knowledge are acquired before dependent performances are introduced.

SHAPING: Gradually changing a student's behavior until it is correct.

SIGNAL: Cue that initiates and directs activity.

ASK STATEMENT: A statement of highly specific action which has a verb and object; for example, sort mail.

ECHNICAL ORDERS: Military regulations which deal with the specific nature of technical materials and equipment.

ERMINAL LEARNING OBJECTIVE: Derived from job performance measures, TLOs are to be attained during training. TLOs are broken down into their component parts which are documented as learning objectives which may be further divided into learning steps. Each TLO contains actions, conditions, and standards.

TESTS: Any device or technique used to measure the performance of a student on a specific task or subject matter.

TESTING CONSTRAINTS: Limitations such as time, money, personnel, facilities, and other resources, which prohibit job performance measures from being identical to the tasks they measure.

TRADE-OFFS: In any systematic approach to instruction, it is necessary to make compromises between what is desirable and what is possible. Ordinarily, these decisions involve increases or decreases in time, money, facilities, equipment, or personnel. Training aids and simulators represent examples of trade-offs.

TRAINER APPRAISAL KIT: A package of instructional materials designed to provide a course instructor with practice in the preparation, presentation, and validation of instruction.

TRAINING: The teaching of job skills. It can take a number of forms such as self-teaching exportable packages, training manuals, individual learning packages, FOJT, or group training.

TRAINING SETTING CRITERIA: In media selection, the options that training must be either small group, large group, individualized at a fixed location, or individualized independent of location.

SYMBOL: Anything that stands for or represents something else. A plus sign (+) is a symbol for the mathematical operation of addition.

SYSTEM MASTER PLAN: Control document used to coordinate the development and implementation of an instructional program.

SYNCHRONIZING PULSE: An audible or inaudible sound used to coordinate the audio and video portions of a slide-tape program so that audio and video (i.e., slide and narration) are coordinated.

SYSTEMS APPROACH: A generic term referring to the orderly process of analysis, design, development, evaluation, revision, and operation of a collection of interrelated elements.

TALK-THROUGH TECHNIQUE: Occurs during the simulation of an operational system; involves talking through each operation in the new system to determine decisions and contingencies.

TARGET POPULATION: The pool of potential entrants to training for which instructional materials are designed and tried out.

TASK DELAY TOLERANCE: A measure of how much delay can be tolerated between the time the need for task performance becomes evident and the time actual performance must begin.

TASK: Formed in clusters which make up duties. A task is the lowest level of behavior in a job that describes the performance of a meaningful function in the job under consideration.

TASK INVENTORY: List that itemizes all of the tasks that make up a selected duty.

TASK LEARNING DIFFICULTY: Refers to time, effort, and assistance required by a student to achieve performance proficiency.

TASK STANDARD: A statement of how well a task must be performed.

TRYOUT: Practice test; the purpose is to make the tryout as realistic as possible by eliminating as many sources of unreliability as possible.

UNDERTRAIN: Provide inadequate training that does not prepare a student to meet regular job performance requirements.

VALIDATION: A process through which a course is revised until it is effective in realizing its instructional goal.

VALIDATION DOCUMENTATION: A report which describes in detail how a specific course of instruction was validated and for what target population.

VALIDATION PROCESS: Testing instructional materials on a sample of the target population to insure that the materials are effective.

VALIDITY: The degree to which a test measures what it claims to measure.

VALUE ENGINEERING: Refers to the process of designing equipment or instruction to meet but not exceed the required outcomes. Ordinarily, it refers to the elimination of features or instructional objectives that have not been demonstrated to be positively necessary.

VIGILANCE LEVEL: General degree of watchfulness or attentiveness to what may come.

VISUAL FORM: In media selection, refers to whether alphanumeric or pictorial characteristics are required in a learning situation.

VISUAL SPECTRUM: The type of color required of instructional materials. Some must be with full color, others may be with black and white or shades of grey.

WITHIN-COURSE TESTS: Administered during a course of instruction to assure that all students are "keeping up" with the learning objectives.

WORK ELEMENTS: The element is the smallest component in the structure of a job. Elements combine to form a task, tasks combine to form a duty, and duties combine to form a job.

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